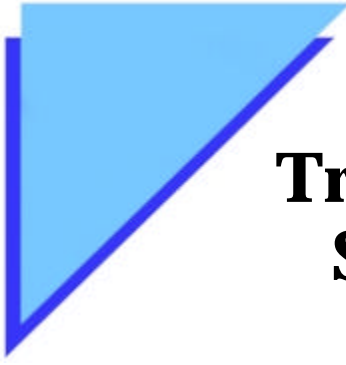# Tri-Services A/E/C CADD Standards Workspace User's Guide

For MicroStation

Developed For

US Army Corps of Engineers

Tri-Service A/E/C CADD Standards Workspace

About the Documentation

The printed documentation supplied with the Tri-Services A/E/C CADD Standards Workspace consists of the following:

- Tri-Service A/E/C CADD Standards – covers the CADD standards developed by the Tri-Services CADD/GIS Technology Center (TSTC) to reduce redundant CADD standardization efforts with the Army, Navy, Air Force and Corps of Engineers.

- User's Guide (this guide) – contains procedures for working with the Tri-Services A/E/C CADD Standards Workspace. The main focus is the proper use of the workspace and not an in-depth coverage of each command in every discipline.

- Training Manual – a one-day class, covering the workspace in a hands-on structured environment.

Document Conventions

Throughout this guide you will encounter common CADD terms, as well as terms specific to MicroStation. Important terms are noted in **bold** text and defined where they first appear.

To familiarize you with the terminology in these guides, the basic operating principles of MicroStation and the Tri-Services WorkSpace (TSWS) are as follows:

- "Press" or "Click" means to press or tap the specified button on or with the graphic input device, as opposed to "press (on) and hold down".

- "Drag" means to press and hold down the specified button while moving the input device and screen pointer.

- Keyboard keys and key combinations are enclosed with angle brackets – for example, <Shift-Return>.

- "Type" means to type a character string.

- "Key in" means to type a character string and then press <Return> (or <Tab> in dialog boxes).

Tri-Service A/E/C CADD Standards Workspace Table of Contents

1 Introduction

Workspace Background

In 1995, several resources of the Tri-Services CADD/GIS Technology Center developed an integrated set of documents that collectively would represent the National CADD Standards. Later, a MicroStation workspace was created to facilitate the usage of these standards. More information can be found about the history of the CADD standards and workspace in the "Preface" of the A/E/C CADD Standards Manual or from the Tri-Services CADD/GIS Technology Center web site at http://tsc.wes.army.mil.

The Workspace consists of four (4) major parts: menus, resource files, cell libraries and the checker. Each of these parts plays a vital part in the overall functionality of the workspace. The menus are used to interface with the user. These menus pull their intelligence from the resource files and cell libraries to aid the user in creating standards compliant drawings. The checker is the last step in ensuring the overall compliance to the standards by informing the user of non-compliant elements.

General Overview

The Tri-Services Workspace will appear transparent to the user. The pull-down menu (Figure 1) is automatically loaded into MicroStation upon startup and will not interfere with any user customizations. Most of the dialog boxes work in the same manner as standard MicroStation dialogs and should be very easy for the experienced user to maneuver through the interface.
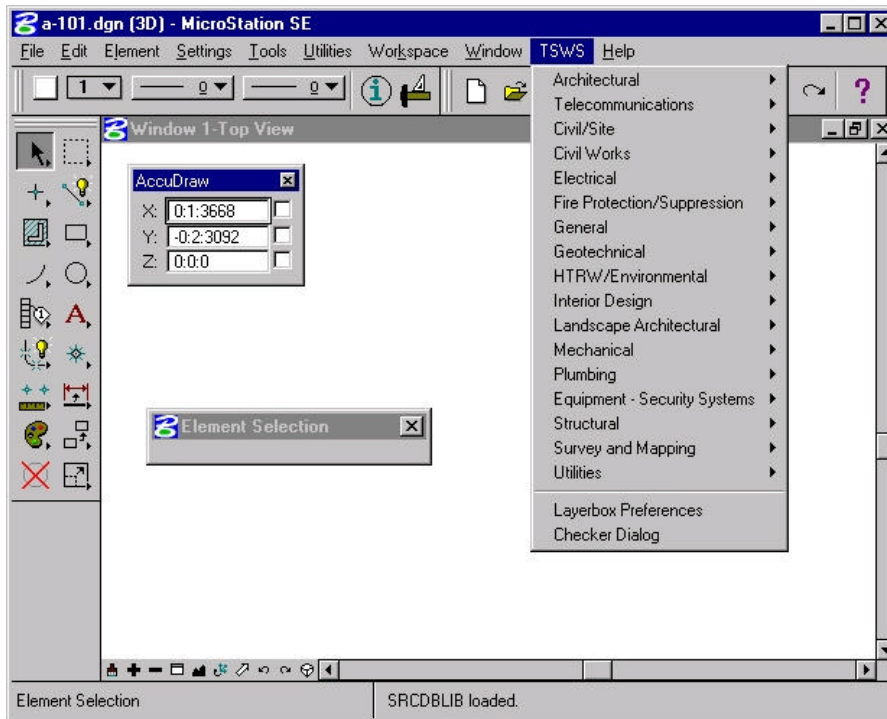
Figure 1 – MicroStation TSWS Interface

Each discipline listed in the TSWS pull-down menu expands to show the corresponding drawing types (Figure 2). For example, the "Electrical" discipline has nine (9) types of drawings including; Demolition Plan, Details, Grounding System, Auxiliary Power Plan, Lighting Plan, One-Line Diagrams, Power Plan, Riser Diagrams and Sheet File. Once a drawing type is selected the user will be prompted for a drawing scale. The drawing scale will affect the size of placed text, symbols and patterning elements. Once the drawing scale is selected a dialog box will be deployed that contains options for other dialogs needed for all corresponding standards. Many of the dialog boxes will only change the "Active Symbology" to reflect the CADD Standards. Others will place elements in the form of text, cells, lines and patterns.
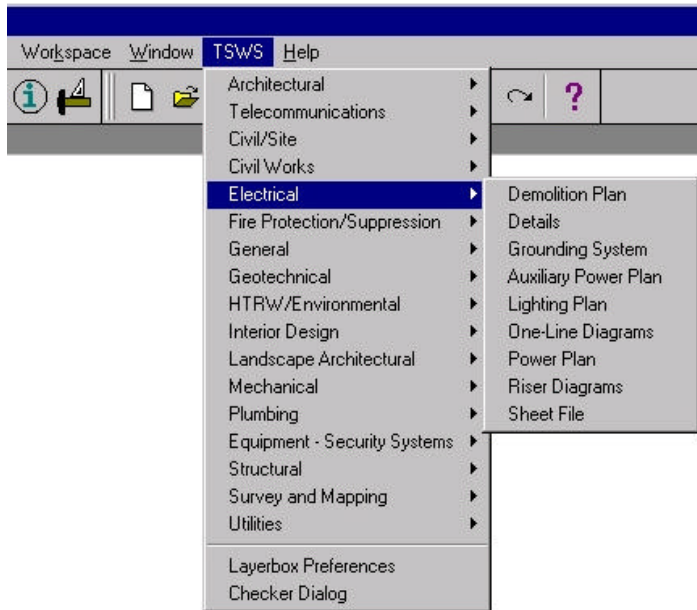
Figure 2 – Discipline Pull-Down Menu

Layerbox Preferences

The Layerbox (Figure 3) in the Tri-Services Workspace is used for selecting the discipline type of elements. This will be the main utility that users will use in selecting the attributes that comply with the Tri-Services A/E/C CADD Standards. Layerbox Preferences is the dialog box used for modifying how the Layerbox operates. In addition, the "Drawing Conditions" button at the bottom of the dialog box can be selected to identify the conditions in which the elements will be placed.
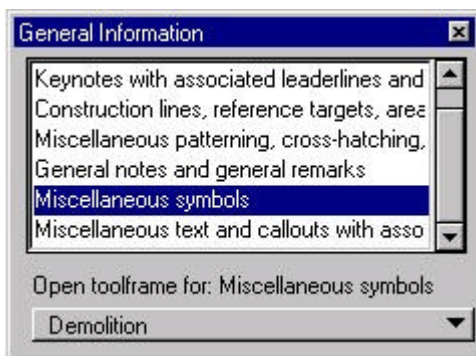
Figure 3 – Layerbox

Opening the Layerbox Preferences

1. Select the TSWS from MicroStation pull-down menu.

2. Pick "Layerbox Preferences" from the TSWS menu listing (Figure 4).
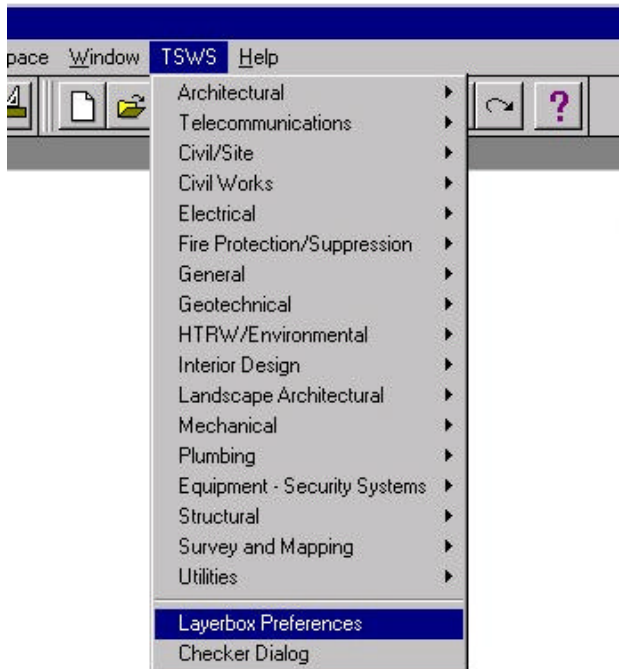
Figure 4 – Opening the Layerbox Preferences

Changing the Layerbox Preferences

The Layerbox Preferences (Figure 5) have been designed to allow the user to modify the vertical size and functionality of the Layerbox.
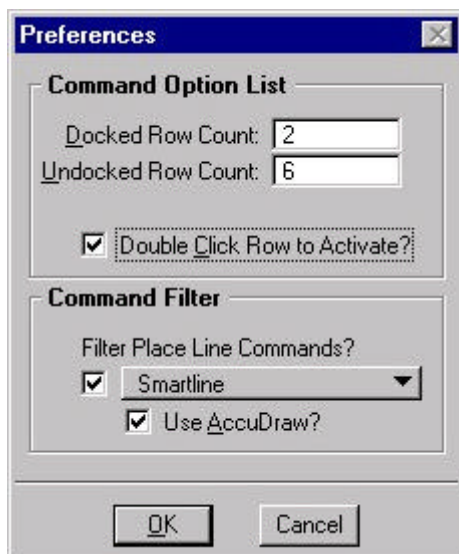
Figure 5 – Layerbox Preferences settings dialog box

The text that is displayed inside of the layerbox is truncated at a set length to optimize screen resolution. A complete alphabetical listing of all text can be found in Appendix A.

Docked Row Count

When the Layerbox is docked into MicroStation's interface (Figure 6), this setting will change the height of the dialog box. The default is "2".
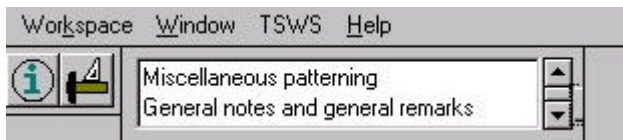
Figure 6 – Layerbox docked into MicroStation's interface

☞ The "Drawing Conditions" button can be seen at the far right side of the docked palette.

Undocked Row Count

When the Layerbox is undocked into MicroStation's interface (Figure 7), this setting will change the height of the dialog box. The default is "6".
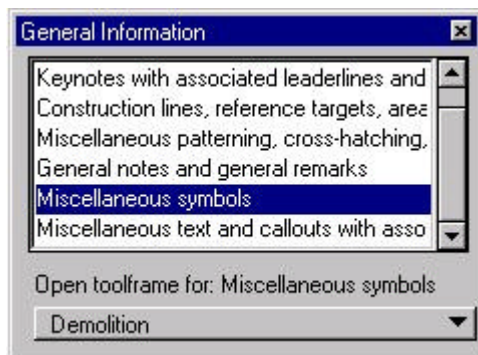
Figure 7 – Layerbox

Double Click Row to Activate

This option can be used to allow for a single or double click to be used in activating an element group in the layerbox.

Command Filter

Selecting an option in the Layerbox will sometimes change the active attribute and also enter the user into an element placement command. The "Command Filter" (Figure 8) allows for Smartline, Line or Linestring to be selected and will be used as the default element type for the

workspace. In addition, the setting shown below allows the user to automatically start AccuDraw each time the default element type is used.
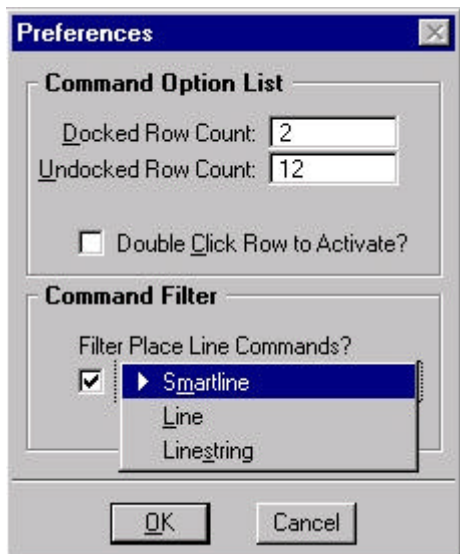
Figure 8 – Layerbox Preferences Command Filter

2 **Drawing File Organization**

Discipline/Drawing Type

The Tri-Services Workspace is broken down into 17 different disciplines, each containing two (2) to 11 drawing types (Figure 1). The different drawing types contain menu selections for all element types. Each element type has a special set of attributes that are automatically set for the user. This will ensure that new elements placed into a drawing will comply with the Tri-Services A/E/C CADD Standards.
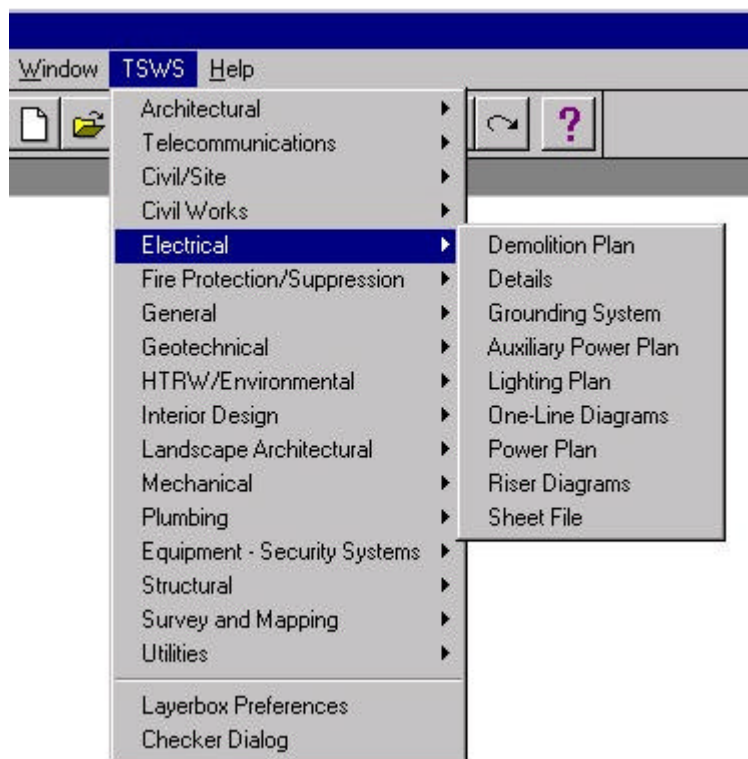
Figure 1 – Example Discipline with Drawing types

Working Units

MicroStation utilizes an integer based file format which has a set number of positional units (PU). These positional units are grouped together in master units (MU) and sub-units (SU). MicroStation refers to this as "Working Units". Recommended working units for MicroStation can be found in Chapter 2 of the Tri-Services CADD/GIS Standards Manual. The delivered seed

files with the workspace already have the appropriate working units assigned; therefore, using the delivered seed files will ensure the proper working units.

After creating a new file, the Tri-Services workspace will warn (Figure 2) the user if the "Working Units" are not properly set for the selected discipline.
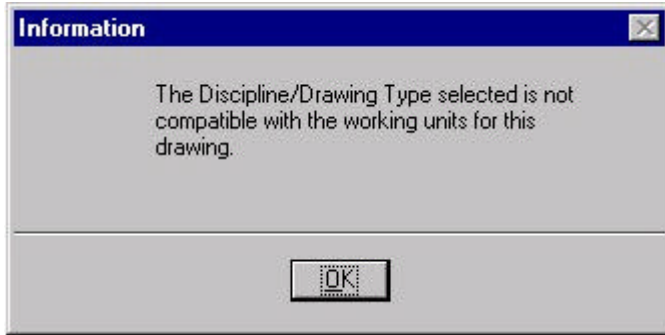
Figure 2 – Working Units incompatibility warning

♠ After you create a design file, but before you begin to draw, you should confirm that the working unit settings provide adequate precision for your design task and a working area that exceeds the projected size of the design. Both requirements can usually be met with large margins.

To set working units:

1. From the Settings menu, choose Design File

    The Design File Settings box (Figure 3) opens
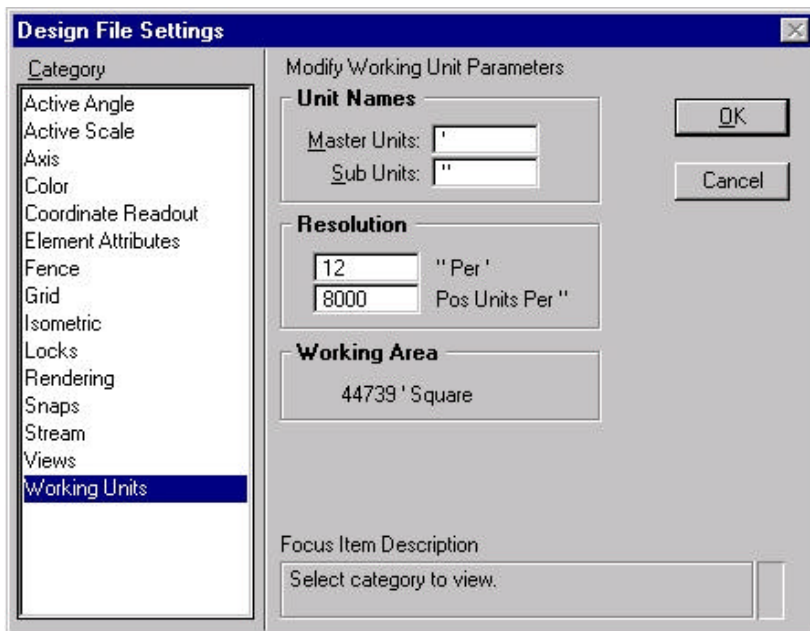
Figure 3 – Design File setting dialog box

2. In the Category list box, select Working Units.

   Controls for adjusting working unit settings are displayed.

3. In the Master Units field, key in one (1) or two (2) characters (such as ' or ft) as the name of the master units.

4. In the Sub Units field, key in one (1) or two (2) characters (such as " or in) as the name of the sub-units.

5. In the Resolution section, key in the number of sub-units per master unit in the first field.

   The label for this field changes with the settings in the master units and sub-units fields.

   It has this syntax: <master_unit_name> Per <sub-unit_name>.

6. In the Resolution section, key in the number of positional units per sub-unit in the second field.

   The label for this field has the syntax: Pos Units Per <sub-unit_name>.

7. Click the OK button.

☞ Working Units cannot be undone; however, the working units are a savable setting. Consequently, one method of recovering from an erroneous working unit is to close and then reopen the design file without saving settings.

Global Origin (go=)

Used for the following (useful for setting up a permanent custom coordinate system, such as when working with maps):

• Relocate the global origin on the design plane.

• Assign coordinates to the global origin.

☞ Global Origin utilizes MicroStation's key-in window (Figure 4) that can be found under "Utilities" or "Help" pull-down menus.
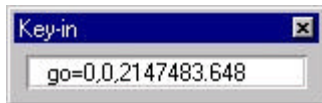
Figure 4 – Key-in browser

Determine the location of the global origin

1. Key in GO=$ <ENTER>

MicroStation displays the distances along the design plane axes from the lower left corner of the design plane to the point with the coordinates (0,0).

Relocate the global origin to the lower left corner of the design plane and assign the coordinates (0,0)

1. Key in GO=0,0 <ENTER>

2. Click Reset

Assign the coordinates (x,y) to the lower left corner of the design plane

1. Key in GO=<x,y>

2. Click Reset

Relocate the global origin to a known location and assign the coordinates (0,0):

1. Key in GO=0,0

   The global origin is temporarily relocated to the lower left corner of the design plane, and the prompt in the status bar is "Enter monument point".

2. Enter a data point on the known location.

Relocate the global origin by assigning coordinates to a known location

1. Key in GO=<x,y>

   <x,y> specifies the coordinates, in working units (MU:SU:PU), to be assigned.

2. Enter a data point on the desired location.

☞ GLOBAL ORIGIN (GO=) cannot be undone; however, the global origin is a savable setting. Thus, one method of recovering from an erroneous GO= key-in is to close and then reopen the design file without saving settings.

Using Model Files and Sheet Files

Model files and sheet files are an important part of the Tri-Services A/E/C CADD Standards. A model file contains the drawing elements and is always drawn at full scale. The files are then referenced into sheet files (Figure 5). The sheet file is a combination of model files and plot specific elements such as title block information and other notes. A sheet file should never be referenced to another file and a model file should always be referenced by a sheet file.
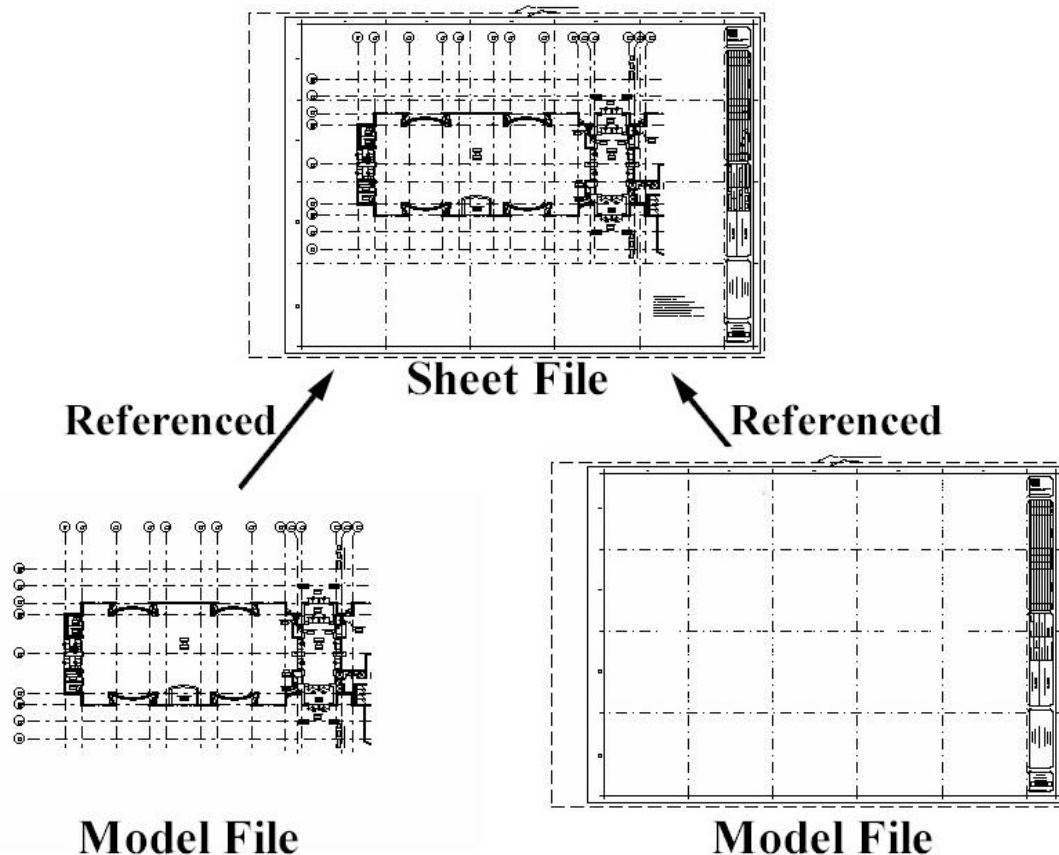
Figure 5 – Sheet/Model File Diagram

Seed Files

Several seed files are delivered with the workspace that are preset to the Tri-Services A/E/C CADD Standards. The following table has a listing of the delivered seed files and their intended use.

Seed File	Dimension	Working Units	Use
I_AEC_2D.DGN	2D	' " 12 - 8000	Imperial (A/E/C)
I_AEC_3D.DGN	3D	' " 12 - 8000	Imperial (A/E/C)
I_CIV_2D.DGN	2D	FT 100 – 10	Imperial (Civil/Site, Civil Works, Geotechnical, Survey/Mapping)
I_CIV_3D.DGN	3D	FT 100 – 10	Imperial (Civil/Site, Civil Works, Geotechnical, Survey/Mapping)
M_AEC_2D.DGN	2D	MM 1 – 10	Metric (A/E/C)
M_AEC_3D.DGN	3D	MM 1 – 10	Metric (A/E/C)
M_CIV_2D.DGN	2D	M 1000 – 1	Metric (Civil/Site, Civil Works, Geotechnical, Survey/Mapping)
M_CIV_3D.DGN	3D	M 1000 – 1	Metric (Civil/Site, Civil Works, Geotechnical, Survey/Mapping)
M_MACH2D.DGN	2D	MM 1000 – 1	Metric (Mechanical Machine Design)
M_MACH3D.DGN	3D	MM 1000 – 1	Metric (Mechanical Machine Design)

File Names

File naming is a vital part of the Tri-Services Workspace. The checker that is used to ensure that all drawings are compliant with the CADD standards uses the file name to determine what type of drawing it is checking. For this purpose it is imperative that the file name is correct. The Tri-Services A/E/C CADD Standards covers all the different methods of naming files.

Sheet File Name

It is recommended that the optional file naming be used for sheet files, as it allows for project code, discipline code, sheet type code, sheet sequence number and a user defined character followed by a dgn extension.

B6AA102X.dgn

```
                        Drawing extension
                        User defined
                        Sheet sequence number
                        Sheet type designator
                        Discipline code/designator
                        Project code
```
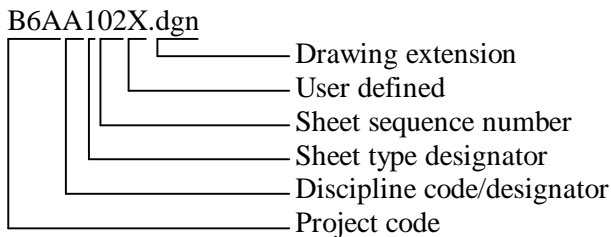
Model File Name

It is recommended that the optional file naming be used for model files, as it allows for project code, discipline code/designator, drawing type code, user defined characters followed by a dgn extension.

B6AFKP02.dgn

```
                        Drawing extension
                        User defined
                        Drawing type code
                        Discipline code/Designator
                        Project code
```
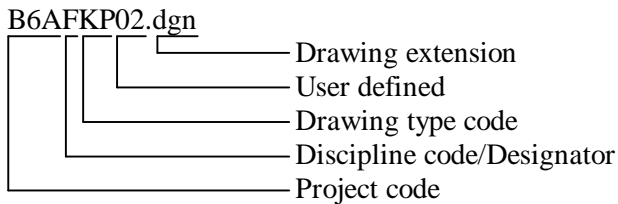
Creation of a Model File

The first step in creating CADD documents for a project is to create model files. This can be broken down into several steps as follows:

1. Create a new design file
    *   Select proper seed file for the discipline/drawing type
    *   Enter a model file name that complies with the CADD standards

2. Verify proper settings
    *   Working Units
    *   Global Origin

3. Select the discipline/drawing type from the TSWS pull down menu. Once this is selected the user will be prompted for the drawing scale.

4. Create the model file graphics at full scale

Create Sheet File

Creation of the sheet file is the main step in presentation of the graphics. The sheet file is the file that will be used for plotting. The main steps in creating a sheet file are as follows:

1. Create a new design file
   - Select proper seed file for the discipline/drawing type
   - Enter a model file name that complies with the CADD standards

2. Verify proper settings
   - Working Units
   - Global Origin

3. Select the discipline/drawing type from the TSWS pull down menu. Once this is selected the user will be prompted for the drawing scale.

4. Attach the necessary model files

5. Create the sheet file graphics

Attach a model file to a sheet file

1. From the File menu, choose Reference

   The Reference Files settings box opens

2. From the settings box Display menu, choose Design

3. From the settings box Tools menu, choose Attach

   The Attach Reference File dialog box opens

4. Select the model file to attach and click the OK button

   A second Attach Reference File dialog box opens

5. In the dialog box Logical name field, key in a brief name (up to 20 characters) for the file. The logical name should be a brief, one (1) or two (2) word description of the model file.

6. (Optional) In the dialog box Description field, key in a description (up to 40 characters) of the file. The Description field can be a more detail description of the model file.

7. From the Attachment Mode option menu, choose Coincident

   ☞ By default, Attachment Mode is set to Coincident

8. (Optional) In the Scale (Master:Ref) fields, define the ratio of design file Master Units to reference file master units. For example:

   ☞ More information on setting model file scale can be found below

9. (Optional) Set Scale Line Styles

   If Scale Line Styles is on, custom line style components (for example, dashes) are scaled by the Scale (Master:Ref) factors. If off, custom line style components are not scaled.

10. Click the OK button

☞ Since the same design file can be attached many times, give the attachments logical names and descriptions that help you remember which attachment is which.

Model File Scale

Model files will typically be scaled to fit inside a border model file. This can be a very complex procedure to calculate the appropriate scale ratio for a design file that may have different scales and working units.

1. Determine the working units and scale of the sheet file.

2. Determine the working units of the model file to reference into the sheet file.

3. Based upon drawing scale, working units of both the sheet and model file will determine the scale for the model file attachment.

💣 Due to MicroStation's integer based file format, some scaled reference file attachments will not be 100% accurate.

Graphics Concepts

Presentation Graphics

In a crowded drawing, it becomes very difficult to distinguish one item from another. This task is even more difficult when all elements look alike. The Tri-Services A/E/C CADD Standards defines distinguishing characteristics for elements in a drawing based upon the discipline and type of element. The Tri-Services workspace used several industry standards to develop a single standard that would work across the variety of disciplines and drawing types used.

Line Weight

Also known as width or thickness, MicroStation allows up to 32 different line weights for elements. These weights are numbered 0 to 31, with 0 being the thinnest. Although there are 32 line weights, only weights 0-15 are accessible through the Line Styles option menu. The Tri-Services A/E/C CADD Standards only uses weights 0, 1, 2, 3, 5, 7, 10 and 15. These line weights are automatically set when using the workspace properly. Each of these weights and usages are defined in Chapter 3 of the Standards Manual. In most situations the TSWS will adjust the weight for the proper element type. Below are the steps for manually setting line weights.

Set the active line weight

1. From the Primary tool bar Line Weight option menu (Figure 1), choose the desired line weight value

    OR

1. From the Element menu, choose *Attributes*. The Element Attributes settings box opens.

2. If you know the number of the desired line weight, key it into the Weight field. Otherwise, choose the desired line weight from the option menu to the right of the Weight field

    OR

1. From the Settings menu, choose *Design File*. The Design File Settings box opens.

2. In the Category list box, select *Element Attributes*.

3. If you know the number of the desired line weight, key it into the Weight field. Otherwise, choose the desired line weight from the option menu to the right of the Weight field.

☞ If you change the Active Line Weight using the tool bar or the Element Attributes settings box, the line weights of selected elements are also changed.
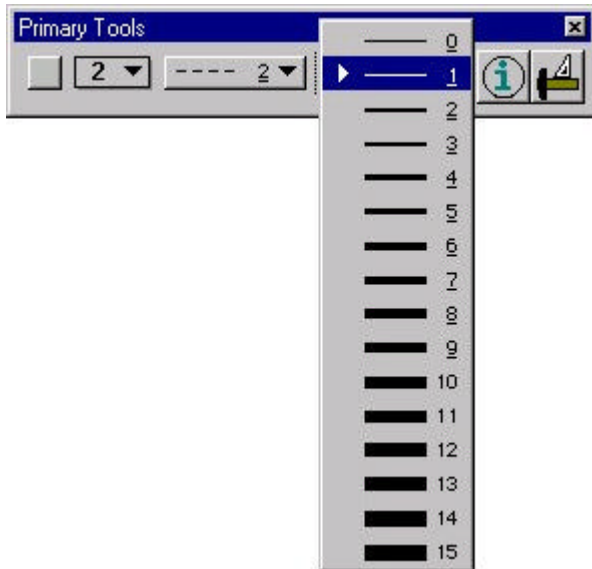
Figure 1 – Active Line Weight Setting Dialog

Line Styles

Line styles are probably the most distinguishing characteristic an element can have. Whether the drawing is in color or black and white, a dashed line always appears as a dashed line. These line styles are automatically set when using the workspace properly. The Tri-Services A/E/C CADD Standards references nine (9) line styles in Chapter 3. The acceptable line styles are 0, 1, 2, 3, 4, 6 and 7. Two (2) additional styles are custom line styles that can be obtained by other sources.

☞ In most cases the TSWS will set the appropriate line style for the discipline and element type.

Set the active line style

- From the Primary tool bar Line Style option menu (Figure 2), choose the desired line style value

    OR

- Key-in: ACTIVE STYLE CSELECT <line_style>
  Line_style can be a standard line style number (0-7) or the name of a custom line style

    OR

- Key-in: LC=<line_style_number>

☞ If one of the standard line styles is chosen, sets the Active Line Style to that line style and changes the line styles of selected elements.

☞ The Line Style sub-menu remembers the four (4) most recent custom line styles and lists those styles above the Custom submenu item.

☞ Choosing Save Settings from the File menu saves the active line style setting to the design file so it may be used as the initial line style setting the next time the design file is opened.
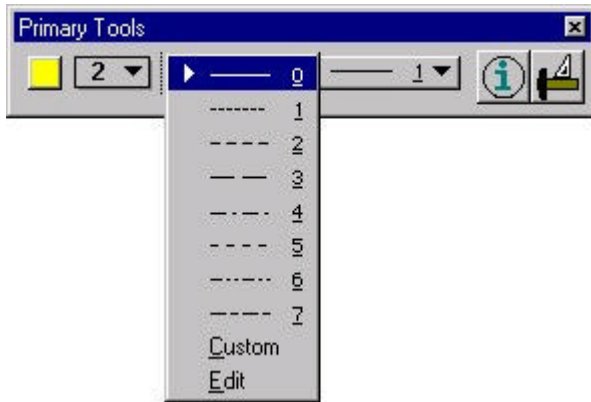
Figure 2 – Active Line Style Setting Dialog

Element Color

MicroStation provides a wide variety of colors to be used. The Tri-Services A/E/C CADD Standards specifies eight (8) colors for general element symbology; Blue, Cyan, Grey, Green, Magenta, Red, White and Yellow. Element colors are automatically set when using the workspace properly. These colors are defined in Chapter 3 of the CADD Standards Manual.

The Active Color specifies the color of an element upon placement and is stored as a value in the 0-255 range. The number of the active color is displayed in two (2) ways: in the color box itself as you move the pointer, and at the bottom of the pop-up color palette in the primary tool bar.

☞ If elements are selected, their colors will change to the newly selected color.

• From the Primary tool bars Color option menu (Figure 3), choose the desired color value

Key-in: ACTIVE COLOR <color_name>

      OR

Key-in: CO=<color_name>

Color name can be the number or the actual name

☞ The color palette represents the active color table, which can have up to 254 usable colors. The active color table can be modified in the Color Table settings box, which is opened by choosing Color Table... from the Settings menu.

☞ Choosing Save Settings from the File menu saves the active color setting to the design file so it may be used as the initial color value the next time the design file is opened.
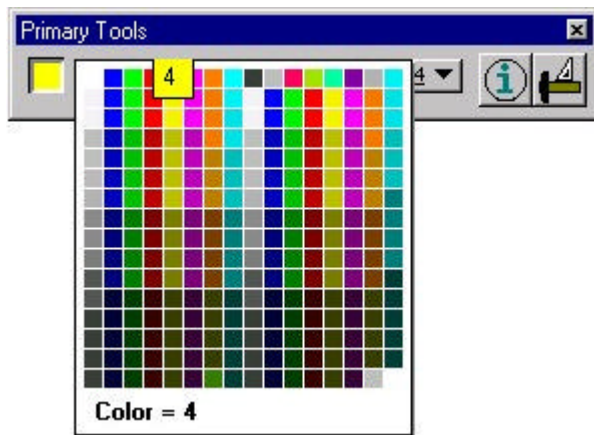
Figure 3 – Active Color Setting Dialog

Screening (Halftoning)

Screening is often used for distinguishing different aspects of a drawing. Plotting elements using different colors does this. Chapter 3 of the Tri-Services A/E/C CADD Standards manual discusses which colors to use for the different shades.

In MicroStation, screening can be done with a pen table inside of the plotting. Pen tables selectively alter the plotted appearance of elements without changing the physical elements. Using different sections for each screen color will allow for easy plot resymbolization without changing the elements (Figure 4).
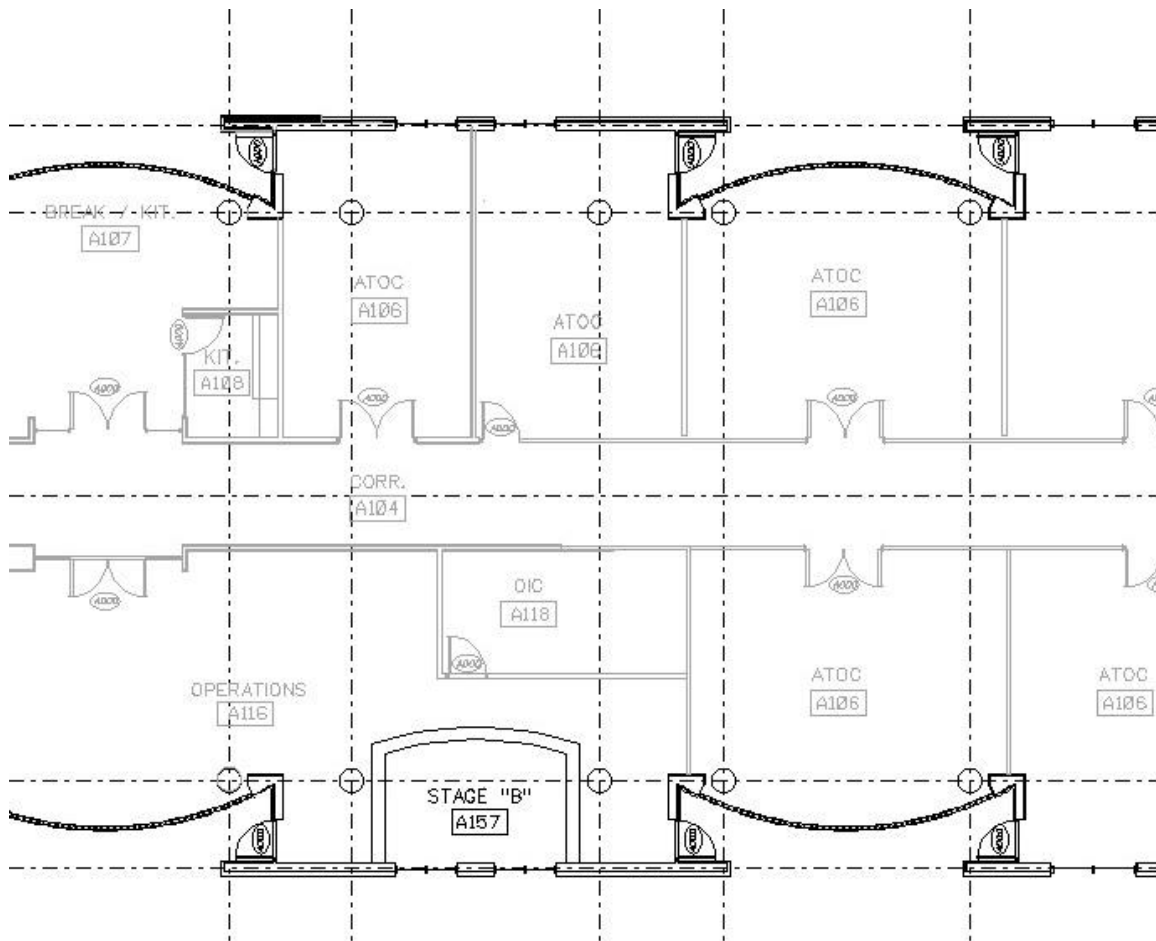
Figure 4 – Example of half toning a drawing to highlight certain objects

Text Styles/Fonts

Text attributes are set within the Tri-Services Workspace when a text element (Text, Notes, and Dimensions) type is selected from a Discipline/Drawing Type menu. Drawing scales will determine the placement size of text, so it is very important to use a proper drawing scale. Text attributes that are set within the workspace automatically for the user include:

- Level
- Color
- Style
- Weight
- Font
- Fractions
- Justification
- Scale (Height, Weight, Line Spacing)

 Text attributes are discussed further in Chapter 3 of the Tri-Services A/E/C CADD Standards.

Border / Title Block

Borders are model files that get referenced into sheet files. These model files contain title block information that will be along the right hand side of the border. Some drawing specific information will be blank and is intended to be filled in using the sheet file.

📖 Borders and Title Blocks are discussed further in Chapter 3 of the Tri-Services A/E/C CADD Standards.

Drawing Scale

Drawing scale should be set when a drawing type is selected from the TSWS pull down menu. It is very important to select the proper scale the first time, as it will affect the placement of many different element types. Once the scale has been changed, any elements placed using a different drawing scale will then be inaccurate and must be changed manually. In MicroStation a scale settings group specifies plotting units relative to design master units. Scale settings groups are used:

- In conjunction with Cell, Active Point, and Area Pattern drawing settings group components, to scale cells while placing them.

- In conjunction with Text and Active Point drawing settings components, to control the sizing and spacing of text while placing it.

To set the active drawing scale

1. Open a design file

2. From the TSWS pull-down menu select the discipline and type of drawing you wish to create

   If the drawing scale is not already set then the *Select Scale* dialog box will open (Figure 5) and allow a scale to be selected

3. Click on the desired scale
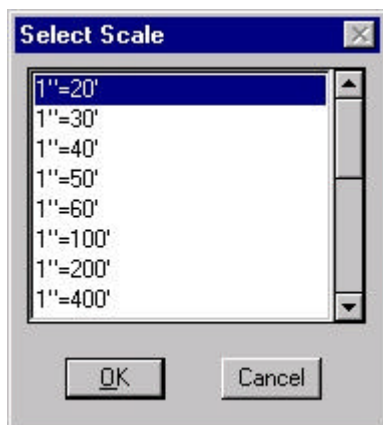
Figure 5 – Drawing Scale Dialog Box

☞ Recommended drawing scales can be found in Chapter 3 of the Tri-Services A/E/C CADD Standards Manual.

4.   Select OK

To change an active scale

1.   From the Settings menu, choose Manage

     The Select Settings window opens (Figure 6)
     .
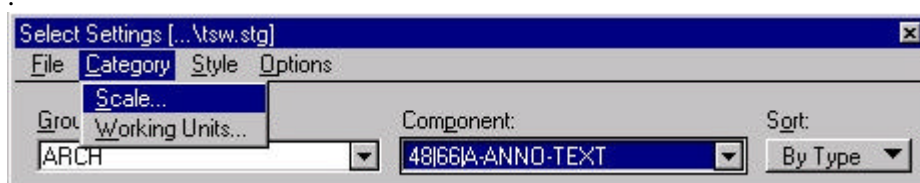
Figure 6 – Settings Manager Dialog Box

2.   From the Category menu, choose Scale

     The Select Scale dialog box opens

3.   In the list box, select the desired group

4.   Click the OK button

☞ Changing a scale setting will not have an effect on the existing elements.

Dimensioning

The Tri-Services workspace has many dimensioning commands in the user interface; however, these commands only set color, level, weight and style. It is up to the users to further define the dimensions if the styles set in the seed files do not match the desired results.

Level Assignments

Levels

Levels in MicroStation are used to organize data. Using the Tri-Services Workspace automatically adjusts the levels to match the element types that the user places. More information on Levels and Level Names can be found in Chapter 4 and Appendix A and C of the Tri-Services CADD Standards Manual.

Setting the active level

1. From the Primary tool bar Level option menu (Figure 1), choose the desired level.

2. To change the Active Level setting, drag the pointer over the level map to the desired level and then release the Data button.

☞ While the pointer is on a level number that corresponds to a named level, the level name is shown below the level map.

     OR

Key-in: ACTIVE LEVEL [level]

     OR

Key-in: LV=[level]
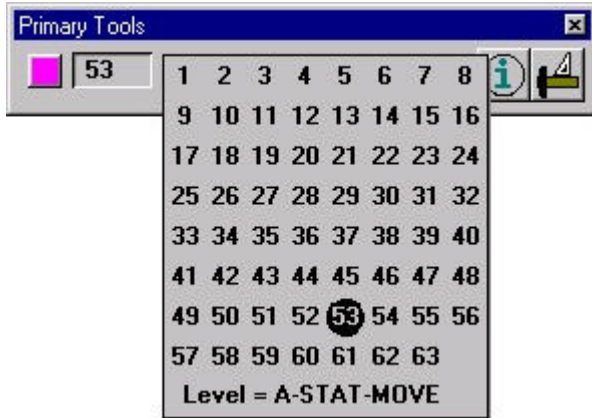
Figure 1 – Setting the active level

☞ The Active Level can also be set in the View Levels settings box, which is opened by choosing Level > Display from the Settings menu or in the Element Attributes settings box, which is opened by choosing Attributes from the Element menu.

☞ Save Settings from the File menu saves the active level setting to the design file. Otherwise it will be returned to its initial value.

☞ Clicking the Level field in the status bar opens a dialog box to set the active level. The appearance of the dialog box depends on the level name set up in user preferences.

Naming Levels

The Level Names settings box (Figure 2) is used to assign names to levels, create groups of levels, and define a level structure. A level structure is composed of level name assignments and level group definitions. Chapter 4 and Appendix A and C of the Tri-Services CADD Standards Manual discuses the naming convention for level names in more detail.

Open the Level Names dialog box

Key-in: DIALOG NAMEDLEVELS

　　　　OR

From the Settings pull-down menu, select Level and then Names.

♣ The Level Names and structure are a collection of settings that must be saved by choosing Compress Design from the File menu. If you do not save settings (or save the level structure as a separate file), when you close the design file in which you have named levels and created groups, the level names and structure are lost.
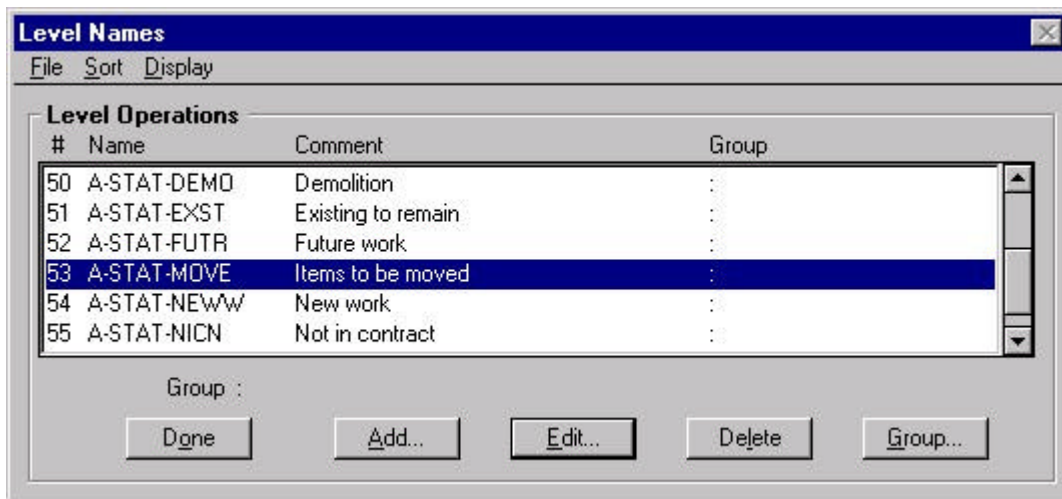
Figure 2 – Level Names dialog box

☞ Before removing the level structure, consider saving it for possible re-use (see "File menu/Save...").

Standard Symbols

Standard Symbols

Standard Symbols such as windows, doors, graphics scale keys, furniture and steel sections can increase productivity and provide an opportunity for standardization. Four (4) types of "Standard Symbols" are mentioned in the CADD Standards; Line Element, Pattern Element, Symbol Element and Object Element. In MicroStation a cell is a small drawing, usually of a frequently used or complex symbol, notation, detail or pattern. Cells are stored in a special kind of file called a cell library, which can contain many cells. The Tri-Services workspace uses many cell libraries in each of the discipline/drawing types.

Pattern Element

Patterns can be used to represent objects in MicroStation such as Earth, Concrete, Aluminum or many others. The patterns are stored in cell libraries as cells. The Tri-Services Workspace automatically converts these cells to a tool palette (Figure 1) for easy viewing and placement. Pattern elements take full advantage of the Drawing Scale so the pattern will always be the proper scale.

☞ Using MicroStation's fly-over Tool Tips will display the cell description. Tool Tips can be turned on by going to the Help menu inside of MicroStation.
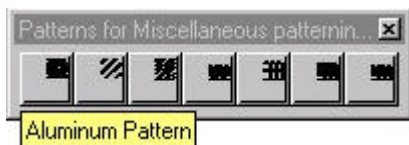
Figure 1 – Automatically created toolbox from a cell library with fly-over Tool Tips

☞ After selecting the drawing type from the discipline menu select the Cells menu item under Elements pull-down menu in MicroStation to view all available cells.

Symbol Element

Symbol elements are MicroStation cells used to represent features of a drawing grouped into a single element for easy placement. When a symbol element command is selected from the layerbox it will open a toolbox (Figure 2) with icons that graphically represent the MicroStation cell. Symbol elements do not have a specific size or scale in which they need to be placed. A symbol that would be placed with a specific size would be an object element. Both the symbol element and object element commands will execute the *Place Active Cell* command within MicroStation.

Figure 2 – Example symbol element toolbox

Object Element

Object elements are MicroStation cells used to represent features of a drawing grouped into a single element for easy placement. When an object element command is selected from the layerbox it will open a toolbox (Figure 3) with icons that graphically represent the MicroStation cell. Object elements have a specific size or scale in which they need to be placed. Object element commands will execute the *Place Active Cell* command within MicroStation.

When properly using the TSWS workspace all object elements will be placed at the proper scale without further user input.

Figure 3 – Example symbol element toolbox

6

Checker Dialog Box

Tri-Services Standards Checker

The Tri-Services Standards checker is the key to verifying standards in drawings. The checker uses a set of rules that reflect the Tri-Services A/E/C CADD Standards Manual. Once the checker has determined the drawing type, it then uses these rules to compare every element in the design file to verify its compliance to the standards. Once the elements have been found not to be in compliance, the user can then highlight the element, make the necessary change in attributes and resample to verify the proper change.

What is checked?

The checker makes symbology checks. It scans the elements in the active drawing to determine their level and then checks to make sure that the linestyle, weight and color are in compliance with that level. It also checks cells to make sure that their name exists in the database. The checker is very thorough in its process of checking elements for compliance; however, some element attributes are not checked by the checker.

Things checked:

- Font
- File name
- Color
- Weight
- Linestyle
- Level
- Cell names

Things **NOT** checked:

- Text height and width
- Cells in a discipline other than their own
- Cells at the wrong scale
- Linework that is not logical (i.e. drawing a wall with symbology of a window)
- Geometrically clean drawings (i.e. lines that don't touch at an intersection)

☞ Proper use of the workspace and drawing techniques will avoid most errors.

Opening the Tri-Service Standards Checker

1. Select *TSWS* from MicroStation pull-down menu.

2. Pick *Checker Dialog* from the TSWS menu listing (Figure 1).
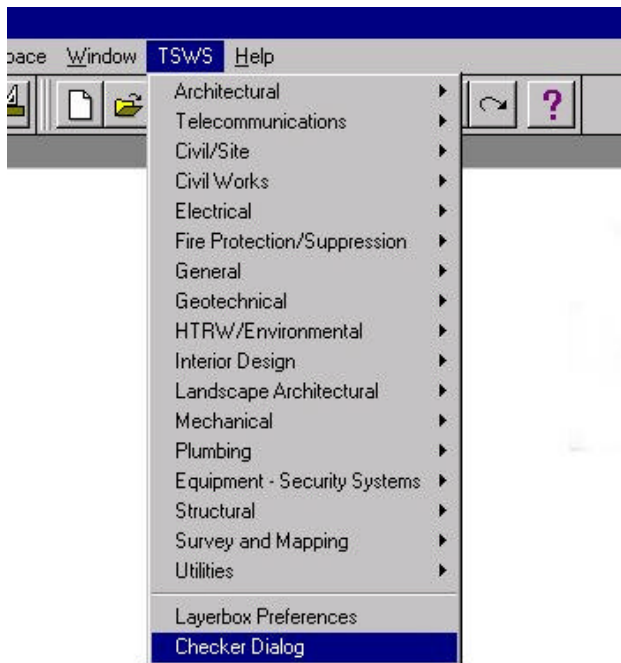
Figure 1 – Opening the Checker Dialog Box

Working with the Tri-Services Standards Checker

The Tri-Services Standards Checker has a very simple interface (Figure 2). The file name is used to determine what discipline and drawing type is to be used for the standards. It then uses its extensive database to check compliance of each element. The non-compliant elements are then listed in the dialog box and can then be located and corrected.

🕭 If the checker returns most elements as non-compliant, verify that the file name and working units are correct.
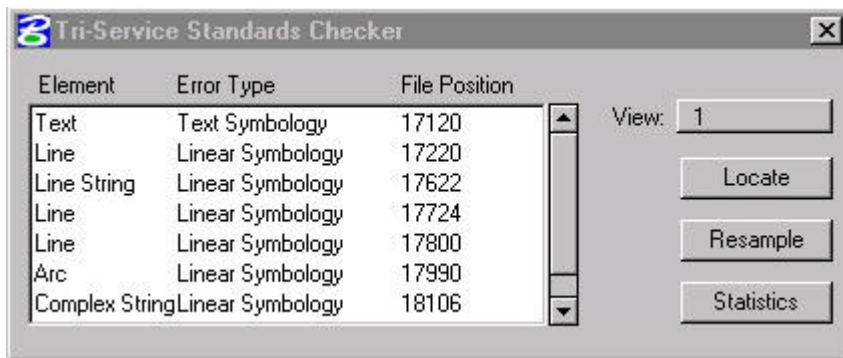
Figure 2 – Checker Dialog Box

Locating Non-Compliant Elements

1. Open the Tri-Services Standards Checker dialog box

2. Select a non-compliant element from the list

3. Pick *Locate* from the dialog box

This will cause MicroStation to zoom into the area of the view (specified in the View: portion of the Tri-Services Standard Checker dialog box) of the selected element and highlight the non-compliant element (Figure 3).

Figure 3 – Locating Non-Compliant Elements

☞ The locator uses the *Element Highlight Color* from MicroStation's design file setting.

Changing the Element Highlight Color

Sets the color in which identified elements are displayed.

Key-in: MDL LOAD HILITE 0

Or

Key-in: SET HILITE [BLACK | BLUE | CYAN | DGREY | GREEN | LGREY | MAGENTA | RED | WHITE | YELLOW]

Or

From the Design File Settings dialog box, select color, then select the Element Highlight Color.

Resample

The Resample button on the Tri-Services Standards Checker restarts the checker. This is used after new elements have been placed or non-compliant elements have been changed.

Statistics

The Statistics button on the Tri-Services Standards Checker returns information about the compliance of elements and total elapsed time per checking session (Figure 4).
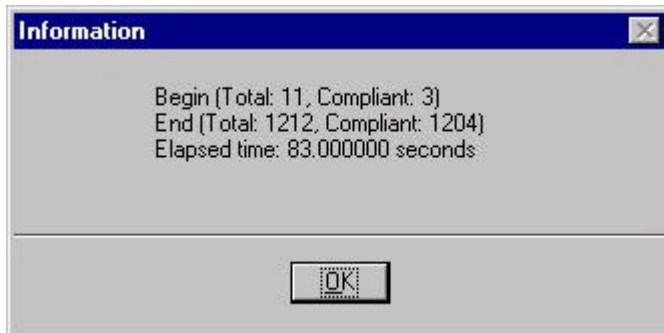
Figure 4 – Statistics information

Finding the Proper Attributes

The proper attributes for elements can be found in the Tri-Services A/E/C CADD Standards Manual or the actual Tri-Services Workspace to help the user locate the proper attributes by simply using the pull-down menu to select the proper type of drawing and then the proper attribute type. This will automatically adjust the active setting within MicroStation.

Changing Non-Compliant Elements

1. Select or fence the element(s)

2. Select the Change Element Attributes tool

3. Select the types of attributes to change (Level, Color, Style, Weight and Class) from the Change Element Attributes dialog box (Figure 5)
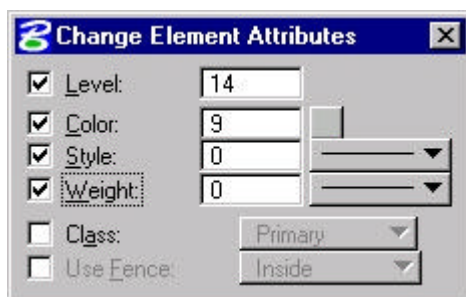
Figure 5 – Change Element Attributes dialog box

4. Accept the change

    OR

1. Select the Change Element Attributes tool

2. Select the types of attributes to change (Level, Color, Style, Weight and Class) from the Change Element Attributes dialog box (Figure 6).
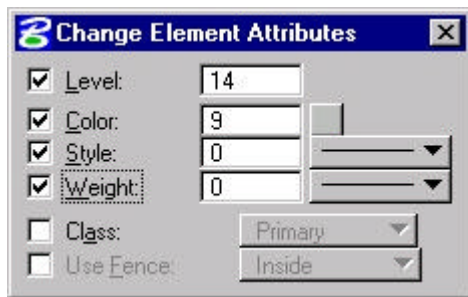
Figure 6 – Change Element Attributes dialog box

3. Identify the element

4. Accept the change

Key-ins can also be utilized with the following syntax:

Key-in: CHANGE ICON

Key-in: [FENCE] CHANGE <CLASS | COLOR | LEVEL | STYLE | WEIGHT>

☞ To change the Active Color, Active Line Style, or Active Line Weight and the corresponding attribute of the selected element(s) in one step, use the controls in the Primary tool bar.

☞ To set the active element attributes so they match those of an element in the design, use the Match Element Attributes tool.

7

Architectural Discipline

The following chapter describes and documents the Architectural Discipline of the Tri-Services Workspace. The Architectural Discipline contains several thousand possibilities of command combinations. In this section we will only cover the main command types for the discipline. All other commands will have similar functionality to the commands documented.

Typical Architectural Commands

The Architectural Discipline includes a variety of commands inside of its interface. These commands are designed to help the user create Tri-Services A/E/C CADD Standards compliant drawings. In the following sections a detailed description of each command type will be given, including:

- Symbology Change
- Cell Placement
- Text Placement
- Note Placement
- Dimension Placement
- Area Pattern Placement

Symbology Change

Symbology changing commands in the Tri-Services workspace will adjust the active setting inside of MicroStation. In some cases the drawing conditions button at the bottom of the Layerbox will alter the symbology settings. The settings that are affected include:

- Color
- Line Weight
- Line Style
- Level

These commands will also execute the Command Filter inside of the Layerbox Preferences dialog box. The command filter includes placing a Smartline, Line and Linestring with an option to automatically start AccuDraw.

Cell Placement

Cell placement commands are used to place discipline specific standard symbols into a MicroStation file. The Tri-Services workspace will automatically retrieve the proper cell from the cell libraries and allow the user to place them using the proper symbology for the drawing type/discipline. In most cases the icon (Figure 1) used for the command will graphically represent the cell.

Figure 1 – Example of a typical toolbox with cell placement commands

Settings affected by a cell placement command include:

- Level
- Color
- Style
- Weight
- Cell Name
- Cell Library
- Scale

Text Placement

Text placement commands are used to place text elements into MicroStation design files using specific attributes. Once a text placement command has been selected the user is automatically entered into the place text command. The following settings are adjusted based on the discipline drawing type, drawing scale and drawing conditions:

- Level
- Color
- Style
- Weight
- Font
- Text Size
- Justification
- Line Spacing

Note Placement

The note placement commands enter the user into the Place Multi-line Note command. It is recommended that the place text command usually located next to the note placement command, (Figure 2) be selected first. This will adjust the text settings to be compliant the Tri-Services A/E/C CADD Standards.

Figure 2 – Note placement command toolbox

Dimension Placement

The dimension placement commands enter the user into the Dimension Size with Arrow command. It is recommended that the place text command, usually located next to the dimension placement command, (Figure 3) be selected first. This will adjust the text settings to be compliant with the Tri-Services A/E/C CADD Standards.

Figure 3 – Dimension placement command toolbox

Area Pattern Placement

Area pattern commands are used in the placement of patterns into a MicroStation design file. In most cases the icon (Figure 4) used for the command will graphically represent the pattern. Once the pattern has been selected the user is automatically placed into the pattern area command.

Figure 4 – Place area pattern toolbox with multiple patterns

The following settings are adjusted based on the discipline drawing type, drawing scale and drawing conditions:

- Level
- Color
- Style
- Weight
- Scale
- Cell Library
- Pattern Cell

Architectural Discipline Drawing Types

Each drawing type will be documented in the following sections. The following is a listing of the different drawing types found in the TSWS – Architectural pull down menu (Figure 5):

- Demolition Plan
- Details
- Elevations (Exterior and Interior)
- Equipment Plan
- Finish Plan
- Floor Plan
- Area Calculations/Occupancy Plan
- Life Safety Plan
- Reflected Ceiling Plan
- Roof Plan
- Sheet File
- Building Sections
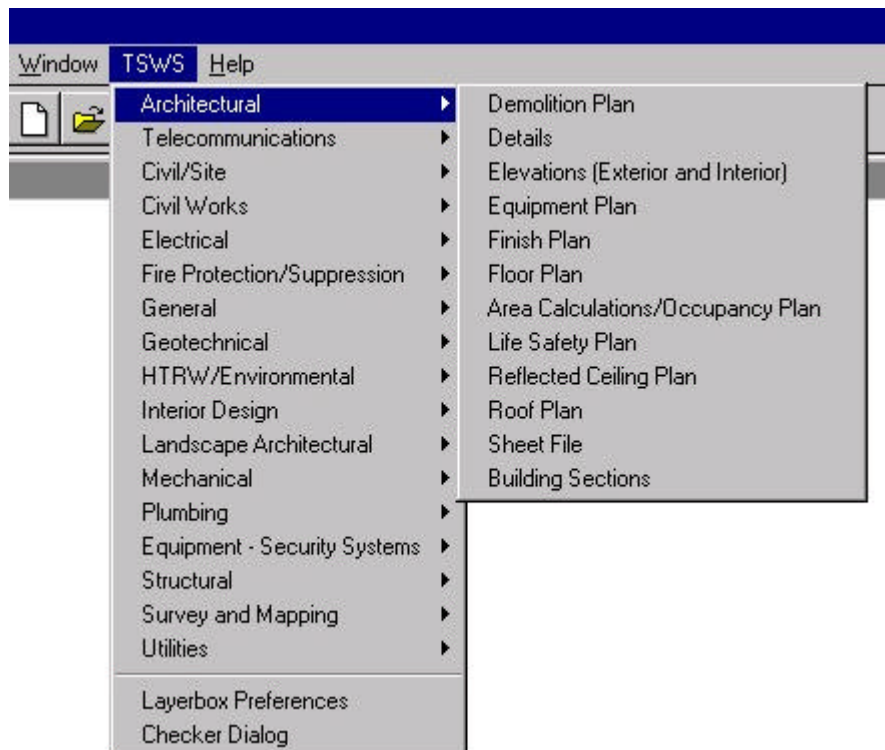
Figure 5 – Architectural Drawing/Discipline Types

Demolition Plan

The two (2) main types of commands in the Demolition Plan drawing type are toolboxes used for placing cells and patterns and active symbology command to change the active setting inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Demolition Plan drawing type. To locate the Demolition Plan drawing type, select TSWS > Architectural > Demolition Plan. This will open the Demolition Plan toolbox (Figure 6) which has commands listed in the Icon Group Name below. Once an icon is selected, the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 6 - Demolition Plan toolbox

Icon Group Name	Layerbox Command	Action
Demolition	Hazardous waste (see HTRW Model File Type: Demolition Plan for more extensive projects)	Change Active Symbology
General Information	Witness/extension lines, dimension arrowheads/dots/slashes, dimension text	Opens "Objects for Floor Deck" toolbox for cell placement
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens "Objects for Roof Deck" toolbox for cell placement
General Information	Construction lines, reference targets, area calculations, review comments	Opens "Patterns for Miscellaneous patterning, cross-hatching, poche" toolbox for cell placement
General Information	Miscellaneous patterning, cross-hatching, poche	Opens "Cells for soil boring layout" toolbox for cell placement
General Information	General notes and general remarks	Opens "Cells for cut/fill slopes" toolbox for cell placement
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens "Cells for Roads, parking lots, railroad, curbs, runways, taxiways, aprons" toolbox for cell placement

Details

The main command types used in the Details Sections drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Details drawing type. To locate the Details drawing type, select TSWS > Architectural > Details. This will open the Details toolbox (Figure 7) which has commands listed in the Icon Group Name below. Once an icon is selected, the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 7 - Details tool box

Icon Group Name	Layerbox Command	Action
Detail Information	Blocking, furring and spacers	Change Active Symbology
Detail Information	Cabinets	Change Active Symbology
Detail Information	Caulking and sealant	Change Active Symbology
Detail Information	Ceiling materials	Opens the "Cells for Gas piping, features, valves and text" toolbox for cell placement
Detail Information	Extrusions and formed shapes	Change Active Symbology
Detail Information	Exterior wall materials	Change Active Symbology
Detail Information	Fasteners	Change Active Symbology
Detail Information	Floor materials	Change Active Symbology
Detail Information	Flashing	Change Active Symbology
Detail Information	Glazing	Change Active Symbology
Detail Information	Grilles and louvers	Change Active Symbology
Detail Information	Hardware	Change Active Symbology
Detail Information	Insulation	Change Active Symbology
Detail Information	Interior wall materials	Change Active Symbology
Detail Information	Masonry	Change Active Symbology
Detail Information	Piping	Change Active Symbology
Detail Information	Roof materials	Change Active Symbology
Detail Information	Structural features	Change Active Symbology
Detail Information	Trim	Change Active Symbology
Detail Information	General features (miscellaneous items)	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of pattern areas
General Information	Miscellaneous symbols	Opens toolbox for placement of lines and cell placement.
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Elevations (Exterior and Interior)

The main command types used in the Elevations (Exterior and Interior) drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Elevations (Exterior and Interior) drawing type. To locate the Elevations (Exterior and Interior) drawing type, select TSWS > Architectural > Elevations (Exterior and Interior). This will open the Elevations (Exterior and Interior) toolbox (Figure 8) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox, commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 8 - Elevations (Exterior and Interior) tool box

Icon Group Name	Layerbox Command	Action
Elevations	Wall-mounted casework	Change Active Symbology
Elevations	Miscellaneous fixtures	Change Active Symbology
Elevations	Finishes, woodwork, trim	Change Active Symbology
Elevations	Component identifications numbers	Opens toolbox for placement of wall type identifiers and text
Elevations	Building outlines	Change Active Symbology
Elevations	Textures and hatch patterns	Opens toolbox for placement of area patterns
Elevations	Plumbing fixtures	Change Active Symbology
Elevations	Signage	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Equipment Plan

The main command types used in the Equipment Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Equipment Plan drawing type. To locate the Equipment Plan drawing type, select TSWS > Electrical > Equipment Plan. This will open the Equipment Plan toolbox (Figure 9) which has commands listed in the Icon Group Name below. Once an icon is selected, the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 9 - Equipment Plan tool box

Icon Group Name	Layerbox Command	Action
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text
Area Information	Equipment access	Change Active Symbology
Area Information	Ceiling Mounted or Suspended Equipment	Change Active Symbology
Area Information	Fixed equipment	Change Active Symbology
Area Information	Equipment identification numbers	Opens toolbox for placement of lines and text
Area Information	Moveable equipment	Change Active Symbology

Finish Plan

The main command types used in the Finish Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Finish Plan drawing type. To locate the Finish Plan drawing type, select TSWS > Electrical > Finish Plan. This will open the Finish Plan toolbox (Figure 10) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 10 - Finish Plan tool box

Icon Group Name	Layerbox Command	Action
Finish Plan	Finish patterns	Opens a place pattern area toolbox
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Opens toolbox for placement of lines and cells
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Floor Plan

The main command types used in the Floor Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Floor Plan drawing type. To locate the Floor Plan drawing type, select TSWS > Electrical > Floor Plan. This will open the Floor Plan toolbox (Figure 11) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 11 - Floor Plan tool box

Icon Group Name	Layerbox Command	Action
Openings	Window sills	Change Active Symbology
Openings	Door and window headers (appear on Reflected Ceiling Plan)	Change Active Symbology
Openings	Door and window jambs (do not appear on Reflected Ceiling Plan)	Change Active Symbology
Plumbing Fixtures	Plumbing fixtures (use only when Plumbing Piping Plan: P-SANR-FIXT is not available)	Change Active Symbology
Plumbing Fixtures	Toilet partitions and handicap grab bars	Change Active Symbology
Railings	Stair and balcony handrails, guard rails (except handicap grab bars)	Change Active Symbology
Stairs	Stair risers/treads, escalators, ladders	Opens toolbox for placement of lines and cells
Walls	Cavity wall lines	Change Active Symbology
Walls	Wall centerlines	Change Active Symbology
Walls	Curtain wall mullions and glass	Change Active Symbology
Walls	Exterior full height walls	Change Active Symbology
Walls	Fire wall designators (patterning)	Opens toolbox for placement of area patterns
Walls	Wall identification/type text or tags	Opens toolbox for placement of text and cells
Walls	Interior full height walls	Change Active Symbology
Walls	Moveable walls/partitions	Change Active Symbology
Walls	Material pattern (e.g., insulation, hatching, and fill)	Opens toolbox for placement of area patterns
Walls	Partial height walls (do not appear on Reflected Ceiling Plan)	Change Active Symbology
Walls	Wall-hung/attached specialties (e.g., fixtures, grab bars, telephone booths, toilet accessories, etc.)	Change Active Symbology

Windows	Full height glazed walls and partitions (see A-WALL-CWMG for curtain walls)	Change Active Symbology
Windows	Window number and symbol	Opens toolbox for placement of text and cells
Windows	Windows and partial height glazed partitions	Opens toolbox for placement of lines and cells
Woodwork	Casework (manufactured cabinets)	Change Active Symbology
Woodwork	Architectural woodwork (field built cabinets and counters)	Change Active Symbology
Ceiling Penetrations	Overhead items (skylights, overhangs etc.)	Change Active Symbology
Columns	Column enclosures/fire protection	Change Active Symbology
Doors	Full height (to ceiling) door: swing and leaf	Change Active Symbology
Doors	Door number and symbol, hardware group, etc.	Opens toolbox for placement of text and cells
Doors	Partial height door: swing and leaf	Change Active Symbology
Doors	Miscellaneous door symbols (e.g., overhead, bifold, pocket, etc.)	Opens toolbox for placement of lines and cells
Elevators	Elevator cars and equipment	Change Active Symbology
Floor Information	Floor mounted/Free standing miscellaneous fixtures (not including toilet fixtures)	Change Active Symbology
Floor Information	Room name, space identification text	Open place text command
Floor Information	Level changes, shafts, ramps, pits, breaks in construction, and depressions	Change Active Symbology
Floor Information	Room/space identification number and symbol	Open place text command
Floor Information	Floor outline/perimeter/building footprint	Change Active Symbology
Floor Information	Material patterns (e.g., paving, tile, carpet)	Opens toolbox for placement of area patterns
Floor Information	Access (raised) flooring	Change Active Symbology
Floor Information	Room perimeter shape (Interior walls)	Change Active Symbology
Floor Information	Signage	Change Active Symbology
Floor Information	Architectural specialties, toilet room accessories (floor mounted only), display cases	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions

General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Area Calculations/Occupancy Plan

The main command types used in the Area Calculations/Occupancy Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Area Calculations/Occupancy Plan drawing type. To locate the Area Calculations/Occupancy Plan drawing type, select TSWS > Electrical > Area Calculations/Occupancy Plan. This will open the Area Calculations/Occupancy Plan toolbox (Figure 12) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 12 - Area Calculations/Occupancy Plan tool box

Icon Group Name	Layerbox Command	Action
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text

General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text
Area Information	Architectural area calculation boundary lines	Change Active Symbology
Area Information	Occupant or employee names	Opens the place text command
Area Information	Area cross hatching	Opens toolbox for placement of area patterns
Area Information	Room numbers, tenant identifications, area calculation	Opens the place text command

Life Safety Plan

The main command types used in the Life Saftery Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Life Safety Plan drawing type. To locate the Life Safety Plan drawing type, select TSWS > Electrical > Life Safety Plan. This will open the Life Safety Plan toolbox (Figure 13) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 13 - Life Safety Plan tool box

Icon Group Name	Layerbox Command	Action
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology

General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text
Life Safety	Egress requirements designator	Opens the place text command
Life Safety	Fire equipment (fire extinguishers)	Change Active Symbology
Life Safety	Travel distances	Change Active Symbology
Life Safety	Wall fire ratings (see also A-WALL-FIRE on Model File Type: Floor Plan)	Opens the place text command

Reflected Ceiling Plan

The main command types used in the Reflected Ceiling Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Reflected Ceiling Plan drawing type. To locate the Reflected Ceiling Plan drawing type, select TSWS > Electrical > Reflected Ceiling Plan. This will open the Reflected Ceiling Plan toolbox (Figure 14) which has commands listed in the Icon Group Name below. Once an icon is selected, the Layerbox commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 14 - Reflected Ceiling Plan

Icon Group Name	Layerbox Command	Action
Ceiling Information	Access panels, ceiling penetrations (see also A-FLOR-OVHD in Model File Type: Floor Plan)	Change Active Symbology
Ceiling Information	Ceiling control joints	Change Active Symbology
Ceiling Information	Ceiling grid	Change Active Symbology
Ceiling Information	Ceiling/roof penetrations	Change Active Symbology
Ceiling Information	Ceiling patterns (e.g., gypsum, plaster, user defined)	Opens toolbox for placement of area patterns
Ceiling Information	Main tees	Change Active Symbology
Ceiling Information	Suspended elements, ceiling mounted specialties (e.g., clocks, fans, etc.)	Change Active Symbology
Diffusers	Other inlets and outlets (use only when Mechanical HVAC symbols are unavailable) see M-HVAC-ODFF	Change Active Symbology

Diffusers	Ceiling return inlets (use only when Mechanical HVAC symbols are unavailable) see M-HVAC-RDFF	Change Active Symbology
Diffusers	Ceiling supply diffusers (use only when Mechanical HVAC symbols are unavailable) see M-HVAC-SDFF	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text
Lights	Ceiling recessed lights (use only when Electrical lighting symbols are unavailable)	Change Active Symbology
Lights	Emergency lights (use only when Electrical lighting symbols are unavailable)	Change Active Symbology
Lights	Surface mounted lights (pendant, etc.)	Change Active Symbology
Lights	Wall mounted lights (use only when Electrical lighting symbols are unavailable)	Change Active Symbology

Roof Plan

The main command types used in the Roof Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Roof Plan drawing type. To locate the Roof Plan drawing type, select TSWS > Electrical > Roof Plan. This will open the Roof Plan toolbox (Figure 15) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 15 - Roof Plan tool box

Icon Group Name	Layerbox Command	Action
Roof Plan	Crickets flow arrows flow info	Opens the place text command
Roof Plan	Roof drains	Change Active Symbology
Roof Plan	Roof internal gutters	Change Active Symbology
Roof Plan	Expansion joints	Change Active Symbology
Roof Plan	Stair handrails, nosing, guard rails	Change Active Symbology
Roof Plan	Level changes	Change Active Symbology
Roof Plan	Roof perimeter/edge, roof geometry	Change Active Symbology
Roof Plan	Roof surface patterns, hatching	Opens toolbox for placement of area patterns
Roof Plan	Roof specialties, accessories, access hatches	Change Active Symbology
Roof Plan	Stair risers/treads, ladders	Change Active Symbology
Roof Plan	Roof walkways	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens tool box for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Sheet File

The sheet file option opens the reference file menu (Figure 16). Sheet files sometimes consist of many model files that are referenced using MicroStation's reference files. No further settings are set with this command.
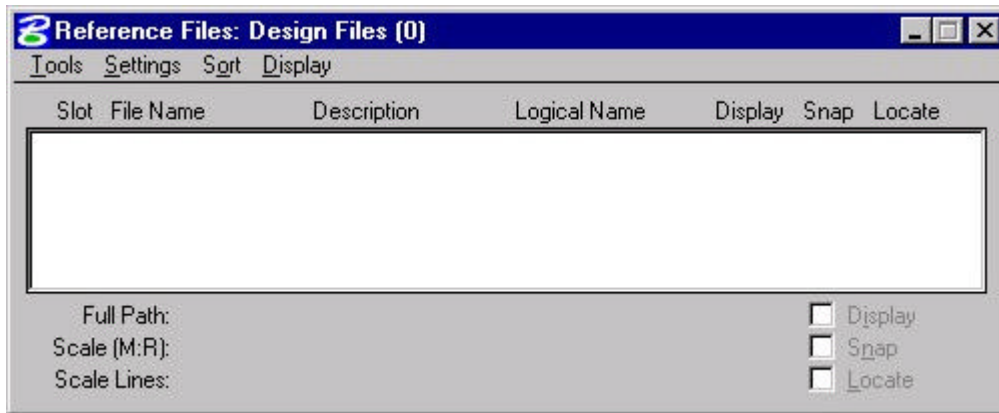
Figure 16 – Reference Files dialog box

Building Sections

The main command types used in the Buiding Sections drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Building Sections drawing type. To locate the Building Sections drawing type, select TSWS > Electrical > Building Sections. This will open the Building Sections toolbox (Figure 17) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 17 - Building Sections tool box

Icon Group Name	Layerbox Command	Action
Sections	Component identification numbers	Opens the place text command
Sections	Material beyond section cut	Change Active Symbology
Sections	Material cut by section	Change Active Symbology
Sections	Textures and hatch patterns	Opens toolbox for placement of area patterns
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text

General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Civil/Site Discipline

The following chapter describes and documents the Civil/Site Discipline of the Tri-Services Workspace. The Civil/Site Discipline contains several thousand possibilities of command combinations. In this section we will only cover the main command types for the discipline. All other commands will have similar functionality to the commands documented.

Typical Civil/Site Commands

The Civil/Site Discipline includes a variety of commands inside of its interface. These commands are designed to help the user create Tri-Services A/E/C CADD Standards compliant drawings. In the following sections a detailed description of each command type will be given, including:

- Symbology Change
- Cell Placement
- Text Placement
- Note Placement
- Dimension Placement
- Area Pattern Placement

Symbology Change

Symbology changing commands in the Tri-Services workspace will adjust the active setting inside of MicroStation. In some cases the drawing conditions button at the bottom of the Layerbox will alter the symbology settings. The settings that are affected include:

- Color
- Line Weight
- Line Style
- Level

These commands will also execute the Command Filter inside of the Layerbox Preferences dialog box. The command filter includes placing a Smartline, Line and Linestring with an option to automatically start AccuDraw.

Cell Placement

Cell placement commands are used to place discipline specific standard symbols into a MicroStation file. The Tri-Services workspace will automatically retrieve the proper cell from the cell libraries and allow the user to place them using the proper symbology for the drawing type/discipline. In most cases the icon (Figure 1) used for the command will graphically represent the cell.

Figure 1 – Example of a typical toolbox with cell placement commands

Settings affected by a cell placement command include:

- Level
- Color
- Style
- Weight
- Cell Name
- Cell Library
- Scale

Text Placement

Text placement commands are used to place text elements into MicroStation design files using specific attributes. Once a text placement command has been selected the user is automatically entered into the place text command. The following settings are adjusted based on the discipline drawing type, drawing scale and drawing conditions:

- Level
- Color
- Style
- Weight
- Font
- Text Size
- Justification
- Line Spacing

Note Placement

The note placement commands enter the user into the Place Multi-line Note command. It is recommended that the place text command, usually located next to the note placement command, (Figure 2) be selected first. This will adjust the text settings to be compliant the Tri-Services A/E/C CADD Standards.

Figure 2 – Note placement command toolbox

Dimension Placement

The dimension placement command enters the user into the Dimension Size with Arrow command. It is recommended that the place text command, usually located next to the dimension placement command, (Figure 3) be selected first. This will adjust the text settings to be compliant the Tri-Services A/E/C CADD Standards.

Figure 3 – Dimension placement command toolbox

Area Pattern Placement

Area pattern commands are used in the placement of patterns into a MicroStation design file. In most cases the icon (Figure 4) used for the command will graphically represent the pattern. Once the pattern has been selected the user is automatically placed into the pattern area command.

Figure 4 – Place area pattern toolbox with multiple patterns

The following settings are adjusted based on the discipline drawing type, drawing scale and drawing conditions:

- Level
- Color
- Style
- Weight
- Scale
- Cell Library
- Pattern Cell

Civil/Site Discipline Drawing Types

Each drawing type will be documented in the following sections. The following is a listing of the different drawing types found in the TSWS – Civil/Site pull down menu (Figure 5):

- Airfield Pavement Plan
- Demolition Plan
- Details
- Airfield Plan
- Grading Plan
- Sections/Elevations
- Site Plan
- Transportation Pavement Plan
- Transportation Site Plan
- Sheet File
- Channel Plan
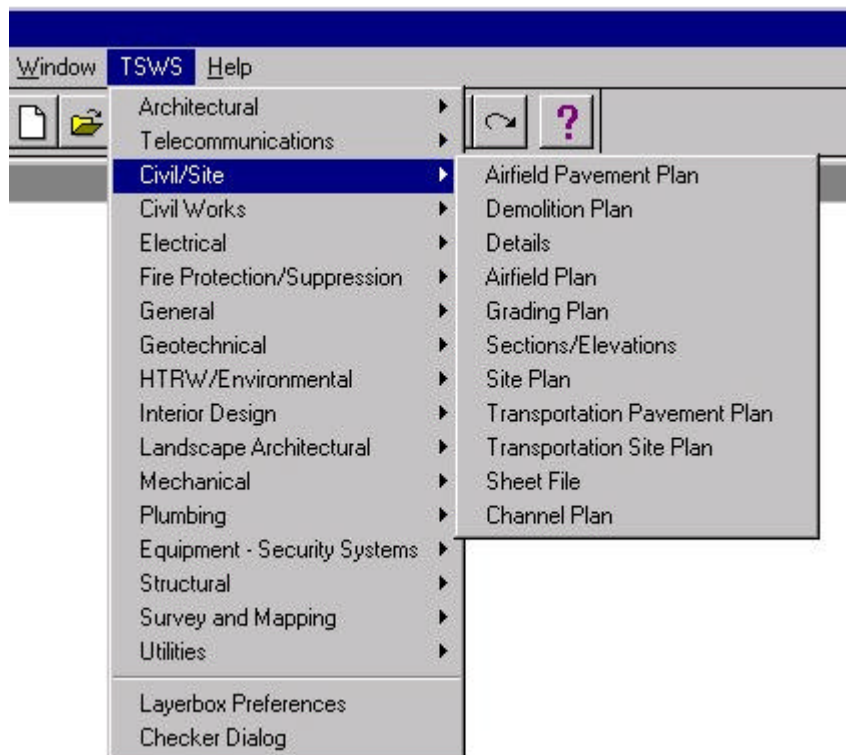
Figure 5 – Architectural Drawing/Discipline Types

Airfield Pavement Plan

The main command types used in the Airfield Pavement Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Airfield Pavement Plan drawing type. To locate the Airfield Pavement Plan drawing type, select TSWS > Civil/Site > Airfield Pavement Plan. This will open the Airfield Pavement Plan toolbox (Figure 6) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 6 - Airfield Pavement Plan toolbox

Icon Group Name	Layerbox Command	Action
Airfield Pavement Types	Type A traffic area with annotation	Opens toolbox for placement of lines and text
Airfield Pavement Types	Type B traffic area with annotation	Opens toolbox for placement of lines and text
Airfield Pavement Types	Type C traffic area with annotation	Opens toolbox for placement of lines and text
General Information	Witness/extension lines, dimension arrowheads/dots/slashes, dimension text	Opens "Objects for Floor deck" toolbox for cell placement
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens "Objects for Roof deck" toolbox for cell placement
General Information	Construction lines, reference targets, area calculations, review comments	Opens "Patterns for Miscellaneous patterning, cross-hatching, poche" tool box for cell placement
General Information	Miscellaneous patterning, cross-hatching, poche	Opens "Cells for soil boring layout" toolbox for cell placement
General Information	General notes and general remarks	Opens "Cells for cut/fill slopes" toolbox for cell placement
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens "Cells for Roads, parking lots, railroad, curbs, runways, taxiways, aprons" toolbox for cell placement

Demolition Plan

The main command types used in the Demolition Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Demolition Plan drawing type. To locate the Demolition Plan drawing type, select TSWS > Civil/Site > Demolition Plan. This will open the Demolition Plan toolbox (Figure 7) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 7 - Demolition Plan tool box

Icon Group Name	Layerbox Command	Action
Demolition	Hazardous waste (see HTRW Model File Type: Demolition Plan for more extensive projects)	Change Active Symbology
General Information	Witness/extension lines, dimension arrowheads/dots/slashes, dimension text	Opens "Objects for Floor deck" toolbox for cell placement
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens "Objects for Roof deck" toolbox for cell placement
General Information	Construction lines, reference targets, area calculations, review comments	Opens "Patterns for Miscellaneous patterning, cross-hatching, poche" toolbox for cell placement
General Information	Miscellaneous patterning, cross-hatching, poche	Opens "Cells for soil boring layout" toolbox for cell placement
General Information	General notes and general remarks	Opens "Cells for cut/fill slopes" toolbox for cell placement
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens "Cells for Roads, parking lots, railroad, curbs, runways, taxiways, aprons" toolbox for cell placement

Details

The main command types used in the Details drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Details drawing type. To locate the Details drawing type, select TSWS > Civil/Site > Details. This will open the Details toolbox (Figure 8) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 8 - Details toolbox

Icon Group Name	Layerbox Command	Action
Detail Information	Concrete	Change Active Symbology
Detail Information	Covers and fittings	Change Active Symbology
Detail Information	Earth	Change Active Symbology
Detail Information	Fasteners	Change Active Symbology
Detail Information	Fencing	Change Active Symbology
Detail Information	Fill	Change Active Symbology
Detail Information	Pavements	Change Active Symbology
Detail Information	Piping	Change Active Symbology
Detail Information	Special features	Change Active Symbology
Detail Information	Structural metal	Change Active Symbology
Detail Information	Tanks	Change Active Symbology
Detail Information	Valves and fittings	Change Active Symbology
Detail Information	General features (miscellaneous items)	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning	Opens toolbox for placement of pattern areas
General Information	Reference bubbles, matchlines and breaklines	Opens toolbox for placement of lines and cell placement
General Information	Detail title text, text and associated leaderlines and arrowheads, notes	Opens toolbox for placement of notes and text

Airfield Plan

The main command types used in the Airfield Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Airfield Plan drawing type. To locate the Airfield Plan drawing type, select TSWS > Civil/Site > Airfield Plan. This will open the Airfield Plan toolbox (Figure 9) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.
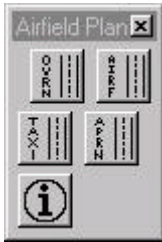
Figure 9 - Airfield Plan toolbox

Icon Group Name	Layerbox Command	Action
Overrun Areas	Centerline annotation	Opens the Place Text command
Overrun Areas	Centerlines	Change Active Symbology
Overrun Areas	Airfield overrun area – annotation	Opens the Place Text command
Overrun Areas	Airfield overrun joints	Change Active Symbology
Overrun Areas	Airfield overrun area – outlines	Change Active Symbology
Runway	Centerlines	Change Active Symbology
Runway	Airfield runway annotation	Opens the Place Text command
Runway	Airfield runway edges	Change Active Symbology
Taxiway	Centerline annotation	Opens the Place Text command
Taxiway	Centerlines	Change Active Symbology
Taxiway	Taxiway - annotation	Opens the Place Text command
Taxiway	Taxiway joints	Change Active Symbology
Taxiway	Taxiway - outlines	Change Active Symbology
Taxiway	Shoulders with annotation	Opens toolbox for placement of lines and text
Apron	Centerline annotation	Opens the Place Text command
Apron	Centerlines	Change Active Symbology
Apron	Airfield apron – annotation	Opens the Place Text command
Apron	Airfield joints	Change Active Symbology

Apron	Airfield apron – outlines	Change Active Symbology
Apron	Shoulders with annotation	Opens toolbox for placement of lines and text
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Grading Plan

The main command types used in the Grading Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Grading Plan drawing type. To locate the Grading Plan drawing type, select TSWS > Electrical > Grading Plan. This will open the Grading Plan toolbox (Figure 10) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 10 - Grading Plan toolbox

Icon Group Name	Layerbox Command	Action
Storm Drainage System	Culverts, drainage inlets, storm drains	Opens toolbox for placement of standard symbols
Storm Drainage System	Storm drain inlets – curb	Change Active Symbology
Storm Drainage System	Ditches with annotation	Opens toolbox for placement of lines and text
Storm Drainage System	Erosion control	Change Active Symbology
Storm Drainage System	Storm drainage headwalls	Change Active Symbology

Storm Drainage System	Culverts, headwalls, drainage inlets - annotation	Opens the Place Text command
Storm Drainage System	Storm drain manholes	Opens toolbox for placement of lines and manhole symbol
Storm Drainage System	Ponds with annotation	Opens toolbox for placement of lines and text
Storm Drainage System	Storm drainage pipe-underground	Change Active Symbology
Borrow Areas	Borrow/Spoil area	Change Active Symbology
Borrow Areas	Borrow/Spoil area annotation	Opens the Place Text command
Topography	Topo breaklines	Change Active Symbology
Topography	Soil boring layout	Opens toolbox for placement of standard boring symbols
Topography	Coordinates	Opens the Place Text command
Topography	Major contours – annotation	Opens the Place Text command
Topography	Major contours	Change Active Symbology
Topography	Minor contours – annotation	Opens the Place Text command
Topography	Minor contours	Change Active Symbology
Topography	Retaining wall	Change Active Symbology
Topography	Cut/fill slopes – annotation	Opens the Place Text command
Topography	Cut/fill slopes	Opens toolbox for placement of standard cut and fill symbols
Topography	Spot elevations	Opens the Place Text command
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Sections/Elevations

The main command types used in the Sections/Elevations drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Sections/Elevations drawing type. To locate the Sections/Elevations drawing type, select TSWS > Electrical > Sections/Elevations. This will open the Sections/Elevations toolbox (Figure 11) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 11 - Sections/Elevations toolbox

Icon Group Name	Layerbox Command	Action
Property	Bearing and distance labels	Opens the Place Text command
Property	Construction limits with annotation	Opens toolbox for placement of lines and text
Property	Easements with annotation	Opens toolbox for placement of lines and text
Property	Right of ways with annotation	Opens toolbox for placement of lines and text
Site	Fences	Change Active Symbology
Site	Handrails	Change Active Symbology
Site	Site annotation	Opens the Place Text command
Site	Site improvements	Change Active Symbology
Site	Ramps	Change Active Symbology
Site	Signs	Opens toolbox for placement of standard sign symbol
Site	Stairs	Change Active Symbology
Site	Walks and trails	Change Active Symbology
Topography	Soil boring layout	Change Active Symbology
Topography	Major contours – annotation	Opens the Place Text command
Topography	Major contours	Change Active Symbology
Topography	Minor contours – annotation	Opens the Place Text command
Topography	Minor contours	Change Active Symbology
Topography	Retaining wall	Change Active Symbology

Topography	Cut/fill slopes – annotation	Opens the Place Text command
Topography	Cut/fill slopes	Change Active Symbology
Topography	Spot elevations	Opens the Place Text command
Topography	Profiles and x-sections, grid borders, grid lines, coordinate grid with annotation	Opens toolbox for placement of lines and text
Building and Primary Structures	Building annotation	Opens the Place Text command
Building and Primary Structures	Building and primary structures – outline	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Opens toolbox for placement of lines and cells
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Site Plan

The main command types used in the Site Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Site Plan drawing type. To locate the Site Plan drawing type, select TSWS > Electrical > Site Plan. This will open the Site Plan toolbox (Figure 12) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.
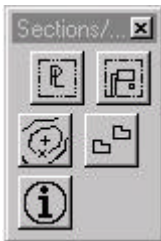

Figure 12 - Site Plan toolbox

Icon Group Name	Layerbox Command	Action
Property	Bearing and distance labels	Opens the Place Text command
Property	Construction limits/controls	Opens toolbox for placement of lines and text
Property	Easements with annotation	Opens toolbox for placement of lines and text
Property	Property lines with annotation	Opens toolbox for placement of lines and text
Property	Right of ways with annotation	Change Active Symbology
Site	Fences	Change Active Symbology
Site	Handrails	Opens the Place Text command
Site	Site annotation	Change Active Symbology
Site	Site improvements	Change Active Symbology
Site	Ramps	Opens toolbox for placement of standard sign symbol
Site	Signs	Change Active Symbology
Site	Stairs	Change Active Symbology
Site	Walks and trails	Change Active Symbology
Survey Lines	Survey and control line	Opens the Place Text command
Survey Lines	Survey and control line annotation	Change Active Symbology
Building and Primary Structures	Building annotation	Opens the Place Text command
Building and Primary Structures	Building and primary structures – outline	Change Active Symbology
Alignments	Alignments	Change Active Symbology
Alignments	Alignment annotation	Opens the Place Text command
Embankments	Embankment centerlines	Change Active Symbology
Embankments	Embankment edge and object lines	Change Active Symbology
Embankments	Embankment annotation	Opens toolbox for placement of lines and text
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens the Place Text command
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Change Active Symbology
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology

General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Transportation Pavement Plan

The main command types used in the Transportation Pavement Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Transportation Pavement Plan drawing type. To locate the Transportation Pavement Plan drawing type, select TSWS > Electrical > Transportation Pavement Plan. This will open the Transportation Pavement Plan toolbox (Figure13) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 13 - Transportation Pavement Plan toolbox

Icon Group Name	Layerbox Command	Action
Pavement	Pavement joints	Change Active Symbology
Pavement	Pavement joint annotation	Opens the Place Text command
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Transportation Site Plan

The main command types used in the Transportation Site Plan drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Transportation Site Plan drawing type. To locate the Transportation Site Plan drawing type, select TSWS > Electrical > Transportation Site Plan. This will open the Transportation Site Plan toolbox (Figure 14) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 14 - Transportation Site Plan toolbox

Icon Group Name	Layerbox Command	Action
Parking Lots and Minor Roads	Graphic illustration of cars	Change Active Symbology
Parking Lots and Minor Roads	Centerline annotation	Opens the Place Text command
Parking Lots and Minor Roads	Centerlines	Change Active Symbology
Parking Lots and Minor Roads	Curbs with annotation	Opens toolbox for placement of lines and text
Parking Lots and Minor Roads	Parking lot drainage slope indications	Opens toolbox for placement of standard flow symbols
Parking Lots and Minor Roads	Parking lots and minor roads – annotation	Opens the Place Text command
Parking Lots and Minor Roads	Parking islands	Change Active Symbology
Parking Lots and Minor Roads	Parking lots and minor roads – outlines	Change Active Symbology
Parking Lots and Minor Roads	Pavement markings	Opens toolbox for placement of standard pavement marking symbols
Parking Lots and Minor Roads	Parking lot striping, handicapped symbols	Opens toolbox for placement of standard Handicapped symbol
Railroads	Centerline annotation	Opens the Place Text command
Railroads	Centerlines	Change Active Symbology
Railroads	Railroad - annotation	Opens the Place Text command
Railroads	Railroad - outlines	Change Active Symbology
Roads	Centerline annotation	Opens the Place Text command
Roads	Centerlines	Change Active Symbology

Roads	Curbs with annotation	Opens toolbox for placement of lines and text
Roads	Guardrails with annotation	Opens toolbox for placement of lines and text
Roads	Road – annotation	Opens the Place Text command
Roads	Road - outlines	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Sheet File

The sheet file option opens the reference file menu (Figure 15). Sheet files sometimes consist of many model files that are referenced using MicroStation's reference files. No further settings are set with this command.
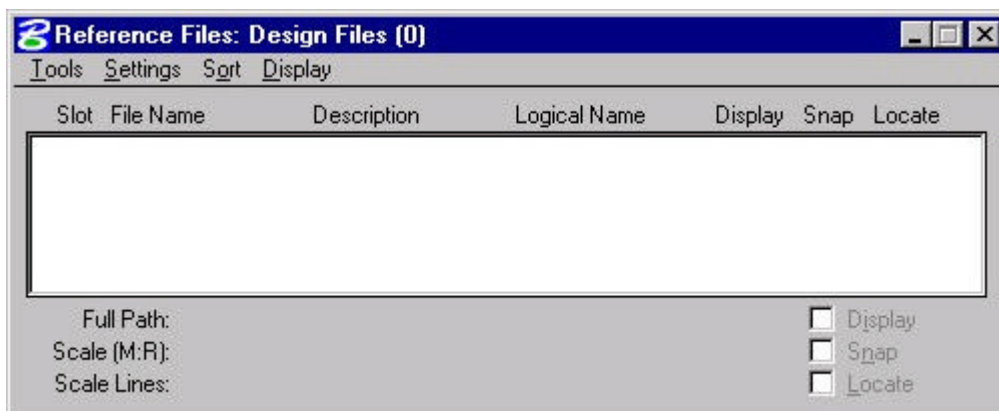
Figure 15 – Reference Files dialog box

Channel Sections

The main command types used in the Channel Sections drawing type are area patterns, cells, notes, text and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Channel Sections drawing type. To locate the Channel Sections drawing type, select TSWS > Electrical > Channel Sections. This will open the Channel Sections toolbox (Figure 16) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 16 - Channel Sections toolbox

Icon Group Name	Layerbox Command	Action
Channels	Centerline annotation	Opens the Place Text command
Channels	Centerlines	Change Active Symbology
Channels	Channel – annotation	Opens the Place Text command
Channels	Channel control limits	Change Active Symbology
Channels	Channel – outlines	Change Active Symbology
Channels	Channel vertical alignment	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Electrical Discipline

The following chapter describes and documents the Electrical Discipline of the Tri-Services Workspace. The Electrical Discipline contains several thousand possibilities of command combinations. In this section we will only cover the main command types for the discipline. All other commands will have similar functionality to the commands documented.

Typical Electrical Commands

The Electrical Discipline includes a variety of commands inside of its interface. These commands are designed to help the user create Tri-Services A/E/C CADD Standards compliant drawings. In the following sections a detailed description of each command type will be given, including:

- Symbology Change
- Cell Placement
- Text Placement
- Note Placement
- Dimension Placement

Symbology Change

Symbology changing commands in the Tri-Services workspace will adjust the active setting inside of MicroStation. In some cases the drawing conditions button at the bottom of the Layerbox will alter the symbology settings. The settings that are affected include:

- Color
- Line Weight
- Line Style
- Level

These commands will also execute the Command Filter inside of the Layerbox Preferences dialog box. The command filter includes placing a Smartline, Line and Linestring with an option to automatically start AccuDraw.

Cell Placement

Cell placement commands are used to place discipline specific standard symbols into a MicroStation file. The Tri-Services workspace will automatically retrieve the proper cell from the cell libraries and allow the user to place them using the proper symbology for the drawing type/discipline. In most cases the icon (Figure 1) used for the command will graphically represent the cell.

Figure 1 – Example of a typical toolbox with cell placement commands

Settings affected by a cell placement command include:

- Level
- Color
- Style
- Weight
- Cell Name
- Cell Library
- Scale

Text Placement

Text placement commands are used to place text elements into MicroStation design files using specific attributes. Once a text placement command (Figure 2) has been selected the user is automatically entered into the place text command. The following settings are adjusted based on the discipline drawing type, drawing scale and drawing conditions:

Figure 2 – Toolbox with a place text command

- Level
- Color
- Style
- Weight
- Font
- Text Size
- Justification
- Line Spacing

Note Placement

The note placement commands enters the user into the Place Multi-line Note command. It is recommended that the place text command usually located next to the note placement command (Figure 3) be selected first. This will adjust the text settings to be compliant the Tri-Services A/E/C CADD Standards.

Figure 3 – Note placement command toolbox

Dimension Placement

The dimension placement commands enter the user into the Dimension Size with Arrow command. It is recommended that the place text command usually located next to the dimension placement command (Figure 4) be selected first. This will adjust the text settings to be compliant the Tri-Services A/E/C CADD Standards.

Figure 4 – Dimension placement command toolbox

Electrical Discipline Drawing Types

Each drawing type will be documented in the following sections. The following is a listing of the different drawing types found in the TSWS – Architectural pull down menu (Figure 5):

- Demolition Plan
- Details
- Grounding System
- Auxiliary Power Plan
- Lighting Plan
- One-Line Diagrams
- Power Plan
- Riser Diagrams
- Sheet File
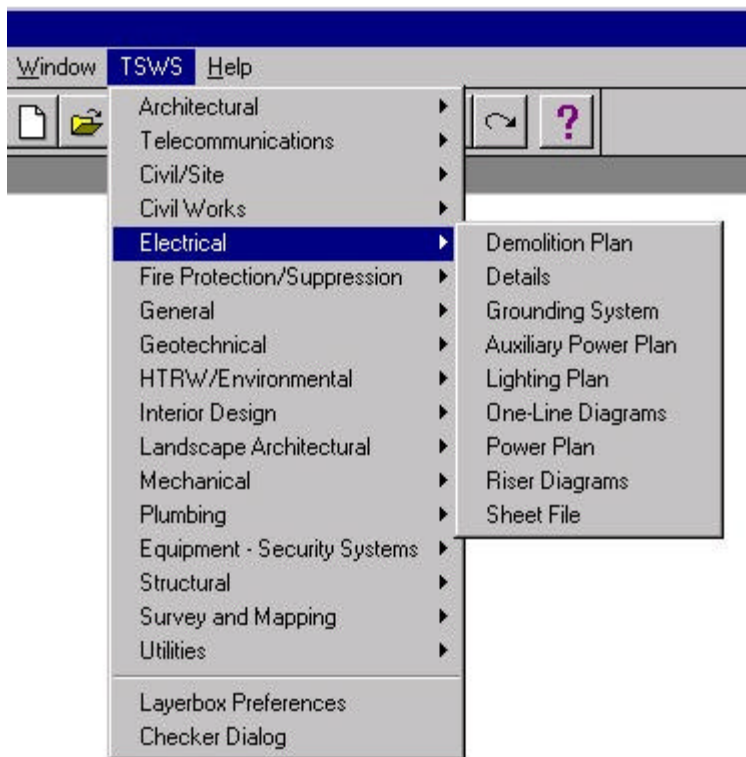
Figure 5 – Electrical Drawing/Discipline Types

Demolition Plan

The main types of commands in the Demolition Plan drawing type include area patterns, text placement and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Demolition Plan drawing type. To locate the Demolition Plan drawing type, select TSWS > Electrical > Demolition Plan. This will open the Demolition Plan toolbox (Figure 6) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 6 - Demolition Plan toolbox

Icon Group Name	Layerbox Command	Action
Demolition	Hazardous waste (see HTRW Model File Type: Demolition Plan for more extensive	Change Active Symbology

	projects)	
General Information	Witness/extension lines, dimension arrowheads/dots/slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of lines and text

Details

The main command types used in the Details drawing type are area patterns, notes, text, stream curves and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Details drawing type. To locate the Details drawing type, select TSWS > Electrical > Details. This will open the Details toolbox (Figure 7) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 7 - Details toolbox

Icon Group Name	Layerbox Command	Action
Detail Information	Architectural features	Change Active Symbology
Detail Information	Bus bars and rods	Change Active Symbology
Detail Information	Cabinets and enclosures	Change Active Symbology
Detail Information	Insulation and coverings	Change Active Symbology
Detail Information	Light fixtures	Change Active Symbology
Detail Information	Motors	Change Active Symbology
Detail Information	Piping and conduit	Change Active Symbology and starts the "Place Point or

		Stream Curve" command
Detail Information	Structural support features	Change Active Symbology
Detail Information	Cable trays	Change Active Symbology
Detail Information	Wire and cables	Change Active Symbology and start the "Place Point or Stream Curve" command
Detail Information	Transformers	Change Active Symbology
Detail Information	General features	Change Active Symbology
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of pattern areas
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Grounding System

The main command types used in the Grounding System drawing type are area patterns, cells, notes, text, stream curves and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Grounding System drawing type. To locate the Grounding System drawing type, select TSWS > Electrical > Grounding System. This will open the Grounding System toolbox (Figure 8) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 8 - Grounding System toolbox

Icon Group Name	Layerbox Command	Action

General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens tool box for placement of notes and text
Ground system	Circuits	Change Active Symbology and starts the "Place Point or Stream Curve" command
Ground system	Ground system diagram	Change Active Symbology
Ground system	Equipotential ground system	Change Active Symbology
Ground system	Reference ground system	Change Active Symbology
Ground system	Grounding system – lighting protection	Opens toolbox for placement of lines and Lightning Arrestor symbol

Auxiliary Power Plan

The main command types used in the Auxiliary Power Plan drawing type are area patterns, cells, notes, text, stream curves and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Auxiliary Power Plan drawing type. To locate the Auxiliary Power Plan drawing type, select TSWS > Electrical > Auxiliary Power Plan. This will open the Auxiliary Power Plan toolbox (Figure 9) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 9 – Auxiliary Power Plan toolbox

Icon Group Name	Layerbox Command	Action
Motor/Generators	Motors and utilization	Opens toolbox for placement

	equipment symbols	of lines and Motor symbol
Motor/Generators	Generators and utilization equipment symbols	Opens toolbox for placement of lines and Generator symbol
Power	Busways	Change Active Symbology
Power	Cable trays	Change Active Symbology
Power	Ceiling receptacles and devices	Opens toolbox for placement of lines and Ceiling mounted pull switch symbol
Power	Feeders	Change Active Symbology and starts the "Place Point or Stream Curve" command
Power	Roof power	Change Active Symbology and starts the "Place Point or Stream Curve" command
Power	Site power (see also utilities disciplines)	Change Active Symbology and starts the "Place Point or Stream Curve" command
Power	Underfloor raceways	Change Active Symbology
Power	Wall outlets and receptacles	Change Active Symbology
Switches	Power switchboards	Change Active Symbology
Switches	Switches, motor starters, contactors, disconnect switches, etc. - symbols	Opens toolbox for placement of lines and Switch symbols
Circuit Lines	Lighting circuits	Change Active Symbology and starts the "Place Point or Stream Curve" command
Circuit Lines	Power circuits concealed in floor and conduit	Change Active Symbology and starts the "Place Point or Stream Curve" command
Circuit Lines	Concealed wiring and conduit	Change Active Symbology and starts the "Place Point or Stream Curve" command
Circuit Lines	Circuit identifiers (e.g., panel circuits, wire/conduit size, tags, etc.)	Opens the place text dialog box
Circuit Lines	Exposed wiring and conduit	Change Active Symbology and starts the "Place Point or Stream Curve" command
Circuit Lines	Power circuits – hash marks	Change Active Symbology
Circuit Lines	Power circuit home run arrows	Opens toolbox for placement of lines and Home Run to Panel Board symbol
Circuit Lines	Power circuit numbers	Opens the place text dialog box
Circuit Lines	Under carpet wiring	Change Active Symbology and starts the "Place Point or Stream Curve" command
Electrical Equipment	Physical outline of equipment	Change Active Symbology
Electrical Equipment	Power outline for backgrounds	Change Active Symbology

Electrical Equipment	Power panels/distribution equipment	Opens toolbox for placement of lines and Panel Board symbols
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text
Junction boxes	Junction boxes	Opens toolbox for placement of lines and Junction Box symbol

Lighting Plan

The main command types used in the Lighting Plan drawing type are area patterns, notes, text, cells, stream curves and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Lighting Plan drawing type. To locate the Lighting Plan drawing type, select TSWS > Electrical > Lighting Plan. This will open the Lighting Plan toolbox (Figure 10) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 10 - Lighting Plan toolbox

Icon Group Name	Layerbox Command	Action
Switches	Switches, contactors, disconnect switches, etc.	Opens toolbox for placement of lines and Dimmer symbol
Circuit Lines	Lighting circuits	Change Active Symbology and start the "Place Point or

		Stream Curve" command
Circuit Lines	Lighting circuits concealed in floor and conduit	Change Active Symbology and start the "Place Point or Stream Curve" command
Circuit Lines	Concealed wiring and conduit	Change Active Symbology and starts the "Place Point or Stream Curve" command
Circuit Lines	Circuit identifiers (e.g. panel circuits, wire/conduit size, tags, etc.)	Opens the place text command
Circuit Lines	Exposed wiring and conduit	Change Active Symbology and starts the "Place Point or Stream Curve" command
Circuit Lines	Lighting circuit hash marks	Change Active Symbology
Circuit Lines	Lighting circuit home run arrow	Opens toolbox for placement of lines and Home Run to Panel Board symbol
Circuit Lines	Lighting circuit numbers	Opens the place text command
Electrical Equipment	Physical outline of electrical equipment	Opens toolbox for placement of lines and Lighting panel symbol
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Opens toolbox for placement of lines and cells
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text
Junction Boxes	Junction boxes	Opens toolbox for placement of lines and Junction Box symbol
Lighting	Ceiling mounted fixtures	Change Active Symbology
Lighting	Emergency fixtures	Opens toolbox for placement of lines and Emergency battery power light fixture symbol
Lighting	Exit fixtures	Opens toolbox for placement of lines and Exit light outlet

		box symbol
Lighting	Floor mounted fixtures (e.g. stage, etc.)	Change Active Symbology
Lighting	Light fixture identifier tags	Opens the place text command
Lighting	Lighting outline for background (optional)	Change Active Symbology
Lighting	Roof lighting	Change Active Symbology
Lighting	Site lighting (see also utilities discipline)	Opens toolbox for placement of lines and Street light with bracket symbol
Lighting	Special fixtures	Change Active Symbology
Lighting	Wall mounted fixtures	Change Active Symbology

One-Line Diagrams

The main command types used in the One-Line Diagrams drawing type are area patterns, cells, notes, text, stream curves and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the One-Line Diagrams drawing type. To locate the One-Line Diagrams drawing type, select TSWS > Electrical > One-Line Diagrams. This will open the One-Line Diagrams toolbox (Figure 11) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 11 - One-Line Diagrams toolbox

Icon Group Name	Layerbox Command	Action
One-Line Diagram Linework	Fine one-line linework	Change Active Symbology and start the "Place Point or Stream Curve" command
One-Line Diagram Linework	Thin one-line linework	Change Active Symbology and start the "Place Point or Stream Curve" command
One-Line Diagram Linework	Medium one-line linework	Change Active Symbology and start the "Place Point or Stream Curve" command
One-Line Diagram Linework	Wide one-line linework	Change Active Symbology and start the "Place Point or Stream Curve" command
One-Line Diagram Linework	Extra wide one-line linework	Change Active Symbology and start the "Place Point or Stream Curve" command

Control Circuit	Antenna	Change Active Symbology
Control Circuit	Arrestor Valves	Change Active Symbology
Control Circuit	Batteries	Opens toolbox for placement of lines and Battery symbol
Control Circuit	Capacitor	Opens toolbox for placement of lines and Capacitor symbol
Control Circuit	Circuit Boards	Change Active Symbology
Control Circuit	Contacts	Opens toolbox for placement of lines and Contact symbols
Control Circuit	Fuses	Opens toolbox for placement of lines and Fuse with rating symbol
Control Circuit	Generators	Opens toolbox for placement of lines and Generator symbol
Control Circuit	Grounds	Opens toolbox for placement of lines and Earth Ground symbol
Control Circuit	Metering Devices	Opens toolbox for placement of lines and Meter symbols
Control Circuit	Motors	Opens toolbox for placement of lines and Motor symbol
Control Circuit	Overloads	Change Active Symbology
Control Circuit	Reactors	Change Active Symbology
Control Circuit	Relays	Change Active Symbology
Control Circuit	Resistors	Change Active Symbology
Control Circuit	Switches	Opens tool box for placement of lines and Switch symbols
Control Circuit	Transformers	Opens toolbox for placement of lines and Transformer symbol
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text

Power Plan

The main command types used in the Power Plan drawing type are area patterns, cells, notes, text, stream curves and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Power Plan drawing type. To locate the Power Plan drawing type, select TSWS > Electrical > Power Plan. This will open the Power Plan toolbox (Figure 12) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 12 - Power Plan toolbox

Icon Group Name	Layerbox Command	Action
Motor/Generators	Motors and utilization equipment symbols	Opens toolbox for placement of lines and Motor symbol
Motor/Generators	Generators and utilization equipment symbols	Opens toolbox for placement of lines and Generator symbol
Power	Busways	Change Active Symbology
Power	Cable trays	Change Active Symbology
Power	Ceiling receptacles and devices	Opens toolbox for placement of lines and Ceiling mounted pull switch symbol
Power	Feeders	Change Active Symbology and start the "Place Point or Stream Curve" command
Power	Roof power	Change Active Symbology and start the "Place Point or Stream Curve" command
Power	Site power (see also utilities disciplines)	Change Active Symbology and start the "Place Point or Stream Curve" command
Power	Underfloor raceways	Change Active Symbology
Power	Wall outlets and receptacles	Change Active Symbology
Switches	Power switchboards	Change Active Symbology
Switches	Switches, motor starters, contactors, disconnect switches, etc. - symbols	Opens toolbox for placement of lines and Switch symbols
Circuit Lines	Power circuits	Change Active Symbology and start the "Place Point or Stream Curve" command
Circuit Lines	Power circuits concealed in	Change Active Symbology

	floor and conduit	and start the "Place Point or Stream Curve" command
Circuit Lines	Concealed wiring and conduit	Change Active Symbology and start the "Place Point or Stream Curve" command
Circuit Lines	Circuit identifiers (e.g., panel circuits, wire/conduit size, tags, etc.)	Opens the place text dialog box
Circuit Lines	Exposed wiring and conduit	Change Active Symbology and starts the "Place Point or Stream Curve" command
Circuit Lines	Power circuits – hash marks	Change Active Symbology
Circuit Lines	Power circuit home run arrows	Opens toolbox for placement of lines and Home Run to Panel Board symbol
Circuit Lines	Power circuit numbers	Opens the place text dialog box
Circuit Lines	Under carpet wiring	Change Active Symbology and start the "Place Point or Stream Curve" command
Electrical Equipment	Physical outline of electrical equipment	Change Active Symbology
Electrical Equipment	Power outline for backgrounds	Change Active Symbology
Electrical Equipment	Power panels/distribution equipment	Opens toolbox for placement of lines and Panel Board symbols
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and callouts with associated leaderlines and arrowheads	Opens toolbox for placement of notes and text
Junction boxes	Junction boxes	Opens toolbox for placement of lines and Junction Box symbol

Riser Diagrams

The main command types used in the Riser drawing type are area patterns, notes, text, stream curves and active symbology command to change the active settings inside of MicroStation for new element placement.

The following is a full listing of the commands and actions inside of the Riser Diagrams drawing type. To locate the Riser Diagrams drawing type, select TSWS > Electrical > Riser Diagrams. This will open the Riser Diagrams toolbox (Figure 13) which has commands listed in the Icon Group Name below. Once an icon is selected the Layerbox Commands will appear in the Layerbox. More information can be found in the Layerbox section in Chapter 1.

Figure 13 - Riser Diagrams toolbox

Icon Group Name	Layerbox Command	Action
Riser Diagram Linework	Fine linework	Change Active Symbology and start the "Place Point or Stream Curve" command
Riser Diagram Linework	Thin linework	Change Active Symbology and start the "Place Point or Stream Curve" command
Riser Diagram Linework	Medium linework	Change Active Symbology and start the "Place Point or Stream Curve" command
Riser Diagram Linework	Wide linework	Change Active Symbology and start the "Place Point or Stream Curve" command
Riser Diagram Linework	Extra wide linework	Change Active Symbology and start the "Place Point or Stream Curve" command
General Information	Witness / extension lines, dimension arrowheads / dots / slashes, dimension text	Opens toolbox for placement of text and dimensions
General Information	Keynotes with associated leaderlines and arrowheads, ConDoc keynotes	Opens toolbox for placement of notes and text
General Information	Construction lines, reference targets, area calculations, review comments	Opens toolbox for placement of lines and text
General Information	Miscellaneous patterning, cross-hatching, poche	Opens toolbox for placement of area patterns
General Information	General notes and general remarks	Opens toolbox for placement of lines and text
General Information	Miscellaneous symbols	Change Active Symbology
General Information	Miscellaneous text and	Opens toolbox for placement

	callouts with associated leaderlines and arrowheads	of notes and text

Sheet File

The sheet file option opens the reference file menu (Figure 14). Sheet files sometimes consist of many model files that are referenced using MicroStation's reference files. No further settings are set with this command.
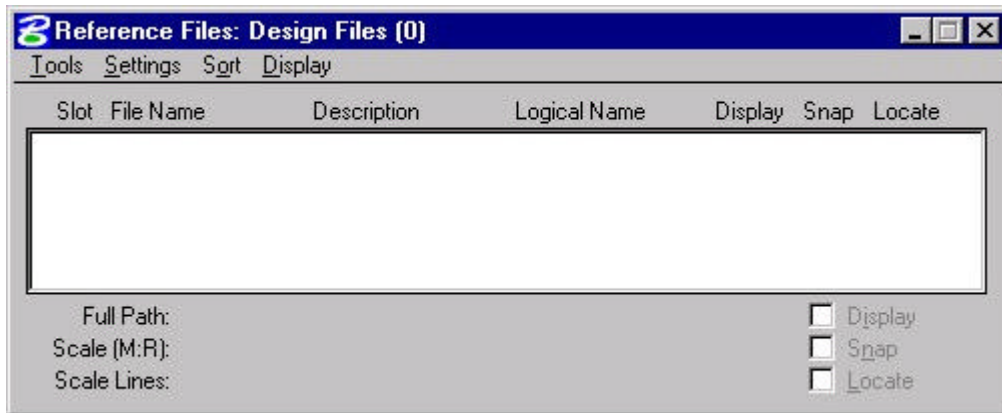

Figure 14 – Reference Files dialog box

Quick Naming Guide

Electronic Drawing File Naming Conventions

Naming conventions for electronic drawing files (both model files and sheet files) allow CADD users to determine the contents of a drawing without actually displaying the file. They also provide a convenient and clear structure for organizing drawing files within project directories. The standard naming conventions provided within this manual are based on the eight-character file name limitation of the DOS operating system. To accommodate the more common conventions currently used within the DoD Tri-Services, this manual provides two (2) acceptable file naming methodologies. These methodologies are the Industry Standard and Tri-Service Optional.

☞ Most current operating systems allow for file names longer than eight (8) characters. However, some file transfer methods (e.g., CD-ROM writers, e-mail) are not able to handle long file names and will truncate the name down to eight-characters. Therefore, this standard will continue to promote eight-character file names until this limitation is resolved.

☞ The Industry Standard file naming conventions are those developed by the AIA (model file naming) and CSI (sheet file naming) as part of the National CADD Standards Initiative.

TABLE 1
Industry Standard Sheet Type Codes/Designators

Drawing Type	Characters
General (symbols, legend, notes, etc.)	0
Plans (horizontal views)	1
Elevations (vertical views)	2
Sections (sectional views)	3
Large Scale (plans, elevations, or sections that are not details)	4
Details	5
Schedules and Diagrams	6
User Defined	7
User Defined	8
3D Views (isometrics, perspectives, photographs)	9

Note: CSI's "Uniform Drawing System" document (Appendix A, UDS-01.35-.41) contains two (2) levels for designating the discipline code/designator based on the complexity of the project. The simplest level, Level One (which is presented here), has the second character being filled by a hyphen (-). Examples would be: Architectural (A-), Electrical (E-), etc. For very complex projects with the possibility of hundreds of sheet files within disciplines, the Level Two discipline codes/designators have the second character filled with a discipline modifier (e.g., Landscape Demolition (LD), Landscape Irrigation (LI), Landscape Planting (LP)). For more information on this topic, please see the UDS document.

The Industry Standard file naming methodology relies solely on directory structure to differentiate individual projects (i.e., all the design files for a particular project are in a directory with the project's name). Some system administrators find this method inadvisable because it permits the same file name to exist in different directories. The possibility of overwriting files with identical names is a constant problem. Figure 7 shows a typical file structure for this method.

☞ Some CD-ROM writing utilities do not recognize a hyphen ("-") as a legal file name character. For these utilities, use either an underscore ("-") for the hyphen or utilize the Tri-Services optional file naming conventions.

Tri-Services Optional Model File Naming Convention

In the Tri-Services Optional model file naming convention, the first three (3) characters of the file name are the Project Code. Project codes are developed by the user and are not standardized. The fourth character represents the Discipline Code/Designator (see Table 2, Note: This table includes disciplines not covered by AIA of CSI, such as Civil Works and Geotechnical). The fifth and sixth characters designate the Drawing Type Code (See Table 3 which includes a sample of these codes, for a full listing see Appendix D. Note: This table includes drawing type codes not covered by AIA or CSI). The remaining two (2) characters are user-definable.

TABLE 2
Tri-Services Optional Discipline

Discipline	Character
General	G*
Survey and Mapping	V
HTRW/Environmental	H*
Civil/Site	C*
Civil Works	W
Geotechnical	B
Utilities	U
Landscape Architecture	L*
Structural	S*
Architectural	A*
Interior Design	I*
Equipment	Q*
Fire Protection/Suppression	F*
Plumbing	P*
Mechanical	M*
Electrical	E*
Telecommunications	T*
Resource	R*
Other Disciplines	X*
Facility Management	N
Contractor/Shop Drawings	Z*
*denotes AIA compliant	

Tri-Services Optional Sheet File Naming Convention

In the Tri-Services Optional sheet file naming convention the first three (3) characters of the file name are the Project Code. Project codes are developed by the user and are not standardized. The fourth character represents the Discipline Code/Designator (see Table 2) and the fifth character defines the sheet type designator (see Table 1). The sixth and seventh characters designate the Sheet Sequence Number (01-99). The remaining character is user-definable.

Example: The sheet file for the first page of a set of Mechanical HVAC Plans for project number "B6A" would be:

B6AM101.dgn

Example: For a building that has multiple floors the Architectural Demolition Plan sheet file name for Sheet 1, Floor 2 would be:

B6AA1012.dgn

Coordination Between Sheet File name and Sheet Identifier

In assigning a sheet identifier (for use in the sheet identification block, reference bubbles, etc.), the user should coordinate with the name assigned to the electronic sheet file. The sheet identifier should consist of the discipline code/designator, sheet type designator, and the sheet sequence identifier/ number. This sheet sequence identifier/number. This sheet identifier convention is compatible with both the Industry Standard and the Tri-Service Optional sheet file naming conventions.

TABLE 3 Tri- Services Drawing Type Codes		
Discipline	**Code**	**Definition**
General (G)		
	BS	Border Sheet
	KP	Keyplan
Surveying and Mapping (V)		
	3D*	Isometric/3D
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP8	Enlarged Plan
	SC*	Section
	SP	Survey/Mapping Plan
HTRW/Environ-mental (H)		
	3D*	Isometric/3D
	AB	Asbestos Sample Location
	DD	Demolition Basin Detail
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	ED	Evapotranspiration Bed detail
	EL*	Elevation
	EP*	Enlarged Plan
	EV	Environmental Plan
	FD	Leachate Field Detail
	GC	Gas Collection System Detail
	GD	Ground Storage Reservoir Detail
	HP	Hydraulic Profile
	LC	Leachate Collection Detail
	LD	Lift Station Detail
	LF	Landfill Liner and Cover Detail
	LP	Lead Paint Sample Location
	OD	Oil Water Separator Detail
	PP	Pollution Prevention Plan

TABLE 3 Tri- Services Drawing Type Codes		(Continued)
Discipline	**Code**	**Definition**
	QP*	Equipment Plan
	SC*	Section
	SD	Spill containment Detail
	ST	Septic Tank Detail
	WD	Water Supply Building Detail
	WP	Water Treatment Plan
	WT	Elevated Water Tank Detail
	WW	Wastewater Treatment Plan
Civil/Site (C)		
	3D*	Isometric/3D
	AF	Airfield Plan
	AI	Airfield Paving Plan
	AP	Apron Striping Plan
	BL	Boring Location
	CP	Channel Plan
	CS	Cross Section
	DD	Storm Drainage Detail
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	DU	Utility Detail
	EC	Erosion Control Detail
	EL*	Elevation
	EP*	Enlarged Plan
	FD	Fence Detail
	GP*	Grading Plan
	IP	Installation Plan
	JD	Joint Detail
	JE	Joint Elevation Plan
	JP	Joint Layout Plan
	KP	Staking Plan
	LD	Lift Station Detail
	LP	Layout Plan
	OD	Oil Water Separator Detail
	PD	Pavement Detail
	PI	Piping Plan
	PL	Project Location Map

TABLE 3		(Continued)
Tri- Services		
Drawing Type		
Codes		
Discipline	**Code**	**Definition**
	PM	Pavement Marketing Plan
	PV	Pavement Plan
	QP	Equipment Plan
	RP*	Road Plan
	SC*	Section
	SM	Sanitary Manhole Detail
	SP*	Site Plan
	SR	Sanitary Sewer Plan
	SS	Sanitary Sewer Plan
	SV*	Survey Plan
	TP	Topography Plan
	TS	Transportation Site Plan
	TX	Topography Plan – Demolition
	UP*	Utility Plan
	WD	Water Detail
	WP	Water Line Profile
Civil Works (W)		
	3D*	Isometric/3D
	CP	Civil Works Plan
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	QP*	Equipment Plan
	SC*	Section
Geotechnical (B)		
	3D*	Isometric/3D
	BL	Boring Location
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	LB	Boring Log
	QP*	Equipment Plan
	SA	Stability Access
	SC*	Section
	SP	Soil Profile
Utilities (U)		
	3D*	Isometric/3D
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EC	ECMS Plan
	EL*	Elevation
	EP*	Enlarged Plan
	EU	Electrical Utilities Plan
	FU	Electrical Utilities Plan
	GA	Gas Utilities Plan
	GE	General

TABLE 3		(Continued)
Tri- Services		
Drawing Type		
Codes		
Discipline	**Code**	**Definition**
	HT	HTCW Utilities Plan
	QP*	Equipment Plan
	SC*	Section
	WA	Domestic Water Plan
Landscape Architecture (L)		
	3D*	Isometric/3D
	AD	Arbor Detail
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	IP	Irrigation Plan
	LP	Landscape Plan
	QP*	Equipment Plan
	SC*	Section
	TP	Turing Plan
Structural (S)		
	3D*	Isometric/3D
	CP	Column Plan
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	FD	Foundation Detail
	FP	Foundation Plan
	FS	Foundation Section
	JL	Joist Girder Load Diagram
	MD	Masonry Detail
	PP	Precast Panel Layout Plan
	QP*	Equipment Plan
	RD	Roof Framing Detail
	RF	Roof Framing Plan
	RP	Reinforcement Plan
	RS	Roof Framing Section
	SC*	Section
	SF	Stair Framing Plan
	TB	Truss Bracing Plan
	TE	Truss Elevation
	WG	Wind Girt Elevation
Architectural (A)		
	3D*	Isometric/3D
	AC	Area Calculations
	BE	Building Elevation
	BS	Building Section
	CP*	Reflective Ceiling Plan
	CW	Casework Detail
	DD	Door Detail
	DG*	Diagram
	DP*	Demolition Plan

TABLE 3		(Continued)
Tri- Services Drawing Type Codes		
Discipline	**Code**	**Definition**
	DT*	Detail
	ED	Exterior Detail
	EL*	Elevation
	EP*	Enlarged Plan
	FP*	Floor Plan
	IE	Interior Elevation
	KP	Key Plan
	LS	Life Safety Plan
	NP*	Finish Plan
	QP*	Equipment Plan
	RP	Roof Plan
	SC*	Section
	WD	Window Detail
	WS	Wall Section
Interior Design (1)		
	3D*	Isometric/3D
	AP	Artwork Placement Plan
	CP*	Ceiling Plan
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	NP*	Finish Plan
	QP*	Equipment Plan
	RP*	Furniture Plan
	SC*	Section
	SD	Signage Detail
	SP	Signage Placement Plan
	WP	System/Prewired Workstation Plan
	WT	System/Prewired Workstation Typical
Equipment (Q)		
	3D*	Isometric/3D
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	KP	Kitchen Plan
	QP*	Equipment Plan
	SC*	Section
	SP	Security Plan
Fire Protection/Suppression (F)		
	3D*	Isometric/3D
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail

TABLE 3		(Continued)
Tri- Services Drawing Type Codes		
Discipline	**Code**	**Definition**
	EL*	Elevation
	EP*	Enlarged Plan
	FS	Fire Suppression Plan
	KP*	Sprinkler Plan
	QP*	Equipment Plan
	SC*	Section
	VP*	Evacuation Plan
Plumbing (P)		
	3D*	Isometric/3D
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	PP*	Plumbing Plan
	PR	Plumbing Riser Diagram
Mechanical (M)		
	3D*	Isometric/3D
	CD	Control Detail
	CP*	Control Plan
	SC	Control Schematic
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EM	EMCS Plan
	EP*	Enlarged Plan
	HC	HVAC Condense Riser Diagram
	HD	HVAC Detail
	HP*	HVAC Ductwork Plan
	HR	HVAC Demolition
	HX	HVAC Demolition Plan
	MH	Material Handling Plan
	PP*	Piping Plan
	QP*	Equipment Plan
	SC*	Section
	SP	Specialty Piping Plan
Electrical (E)		
	3D*	Isometric/3D
	AP	Auxiliary Power Plan
	CP*	Communication Plan
	CR	Communication Riser
	CX	Communication Demolition Plan
	DG*	Diagram
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	GP*	Grounding Plan
	LD	Lighting Fixture Detail

TABLE 3 (Continued) Tri- Services Drawing Type Codes		
Discipline	**Code**	**Definition**
	LP*	Lighting Plan
	LR	Lighting Protection Plan
	LX	Lighting Plan- Demolition
	PP*	Power Plan
	PR	Power Riser
	PX	Power Plan – Demolition
	QP*	Equipment Plan
	SC*	Section
Telecom-munications (T)		
	3D*	Isometric/3D
	CD	Communication System Plan
	DG*	Diagram
	DA*	Data Plan
	DP*	Demolition Plan
	DT*	Detail
	EL*	Elevation
	EP*	Enlarged Plan
	QP*	Equipment Plan
	SC*	Section
	TP*	Telephone Plan

- Denotes AIA compliant

Model File Name

B6AELD01.DGN

B6A	Project Code
E	Discipline Code – Table 2
LD	Drawing Type – Table 3
01	User Definable
.DGN	Drawing Extension

Sheet File Name

B6AA101X.DGN

B6A	Project Code
A	Discipline Code – Table 2
1	Sheet Type – Table 1
01	Sheet Sequence
X	User Definable
.DGN	Drawing Extension

Layerbox Definitions

Alphabetical listing of Layerbox Definitions

Abandoned cables
Abandoned electrical utility lines
Abandoned piping
Access (raised) flooring
Access control unit/panel
Access panels, ceiling penetrations (see also A-FLOR-OVHD in Model File Type: Floor Plan)
Accessories
Accessories (vestibule matts, partitions, draperies, clocks, trash cans, lecterns, lamps, etc.)
Acid, alkaline, and oil waste equipment
Acid, alkaline, and oil waste piping
Acid, alkaline, and oil waste vent piping
ADA standards and guidelines
Air eliminators, filter strainers, hydrant fill points, line vents, markers, meters, oil/water separators, pumps, reducers, regulators, tanks, and valves
Air system equipment
Airfield runway annotation
Airfield apron - annotation
Airfield apron - outlines
Airfield joints
Airfield overrun area - annotation
Airfield overrun area - outlines
Airfield overrun joints
Airfield runway edges
Alignment annotation
Alignments
All circuit Lines
All access control information
All alignment information
All annunciation information
All apron information
All aqueous film equipment and piping information
All Area Information
All assessment/closed circuit television information
All barrier information
All beam information
All bell system information
All block/riser diagram linework information
All borrow/soil area information
All bracing information

All brine system information
All Building and other structure Information
All building and primary structure information
All Casework and Woodwork Information
All Ceiling Information
All Centerline Information
All central dictation system information
All channel information
All chilled water system information
All clock system information
All CO2 equipment and piping information
All Column Enclosures/Fire Protection Information
All column information
All communication information
All control circuit information
All control equipment information
All control information
All Control system information
All data/LAN system information
All deck information
All dental piping information
All diffuser information
All domestic water piping system information
All Door 3d View Information
All Door and Window Header and Jamb Information
All dual temperature system information
All ductwork and equipment information
All ductwork information
All Electrical Equipment information
All Elevator Cars and Equipment Information
All embankment information
All energy management information
All energy monitoring control system information
All energy recovery system information
All equipment information
All Erosion Control Information
All exhaust information
All exhaust makeup information
All fire alarm and detection system information
All fire suppression system information
All Floor Plan Information
All foundation information
All free standing equipment information
All fuel distribution information
All fuel system information
All Glazing Information
All grading information
All grating information
All grid line information
All Ground Systems
All guy wire information

All halon equipment and piping information
All Handrail and Guard Rail Information
All high pressure compressed air information
All hot water heating system information
All hydraulic system information
All hydroseeding information
All Identifiers and leaderlines
all industrial exhaust information
All industrial waste piping information
All industrial Waste Water Piping
All industrial Water Information
All inert gas equipment and piping information
All Inlets, Outlets and Diffuser Information
All insulating (transformer) oil information
All intercom/public address system information
All irrigation information
All joint information
All Junction box Information
All Junction boxes
All laboratory piping information
All landscape plant information
All life safety information
All light information
All Lighting circuit information
All Lighting fixtures
All low pressure compressed air information
All lubrication oil information
All machine design information
All material handling information
All medical gas piping information
All miscellaneous alarm system information
All Miscellaneous Fixture Information
All miscellaneous support information
All Motor information
All natural gas (or liquid petroleum) piping information
All nurse call system information
All One-Line Diagram Linework information
All open web joist information
All Overhead Item Information
All overrun information
All parking and minor road information
All Pavement Information
All pavement joint information
All pavement/transportation information
All Physical outline of electrical equipment (e.g., panels, etc.)
All piping information
All pit information
All plant information
All Plumbing Fixture and Toilet Partition Information
All pole information
All Power circuit information

All Power information
All primary electrical cable information
All process piping information
All property information
All railroad information
All refrigeration system information
All reservoir information
All road information
All Roof Information
All runway information
All sanitary drainage piping
All sanitary drainage piping information
All secondary electrical cable information
All security dedicated lighting information
All security system information
All service cable information
All site information
All slab outline information
All sound system information
All sprinkler system information
All stair information
All Stair, Escalator and Ladder Information
All station drainage information
All station information
All steam system information
All storm drainage information
All storm drainage piping information
All survey information
All Switch information
All switches / contacts
All system furniture information
All taxiway information
All telephone system information
All television system information
All topography information
All traffic area information
All transformer information
All Treatment plants
All turf information
All turfing information
All utility information
All Wall Centerline Information
All wall information
All Window Sill Information
All wiring system information
Annotation
Annunciation equipment control unit/panel
Anode test stations
Antenna
Architectural area calculation boundary lines
Architectural features

Architectural specialties, toilet room accessories (floor mounted only), display cases
Architectural woodwork (field built cabinets and counters)
Area cross hatching
Arrestor Valves
Arrestor Valves
Artwork
Automated Data Processing Components
Batteries
Beam centerlines
Bearings and distance labels
Bell system symbols
Blocking, furring and spacers
Boilers
Booster stations
Border and title block linework
Bore/perk hole locations
Boring locations
Borings/perk holes
Borrow/Spoil area
Borrow/Spoil area annotation
Boulders and cobble
Breaklines
Bridge cranes, jib cranes, and monorails
Bridges
Bridging
Brine system equipment
Brine system piping
Building and primary structures - outline
Building annotation
Building outlines
Buildings and other structures
Buildings and other structures annotation
Buried sensor
Bus bars and rods
Busways
Cabinets
Cabinets and enclosures
Cable identifiers
Cable tray and wireway symbols
Cable trays
Capacitor
Capacitors
Capacitors, voltage regulators, motors, buses, generators, meters, grounds, and markers
Caps
Caps and cleanouts
Caps and flanges
Caps, crosses, and tees
Case goods (desks, credenzas, beds, dressers, nightstands, wardrobes, etc.)
Casework (manufactured cabinets)
Caulking and sealant
Cavity wall lines

Ceiling control joints
ceiling diffusers
Ceiling grid
Ceiling materials
Ceiling mounted and suspended equipment
Ceiling mounted CCTV
Ceiling mounted communication equipment
Ceiling mounted fixtures
Ceiling Mounted or Suspended Equipment
Ceiling mounted security lighting
Ceiling mounted sensor
Ceiling patterns (e.g., gypsum, plaster, user defined)
Ceiling receptacles and devices
Ceiling recessed lights (use only when Electrical lighting symbols are unavailable)
Ceiling return inlets (use only when Mechanical HVAC symbols are unavailable) see M-HVAC-RDFF
Ceiling sprinkler heads
Ceiling supply diffusers (use only when Mechanical HVAC symbols are unavailable) see M-HVAC-SDFF
Ceiling/roof penetrations
Centerline annotation
Centerlines
Central dictation system symbols
Chairs, sofas, etc.
Channel - annotation
Channel - outlines
Channel control limits
Channel vertical alignment
Child development (play toys, teaching rugs, play forms)
Chilled water plant
Chilled water service piping
Circuit Boards
Circuit Boards
Circuit identifiers (e.g. panel circuits, wire/conduit size, tags, etc.)
Circuit identifiers (e.g., panel circuits, wire/conduit size, tags, etc.)
Circuits
Clock system symbols
CMU outline (no patterning)
CO2 piping or CO2 discharge nozzle piping
Coax cable
Code identification
Coils and fin tubes
Column centerlines
Column enclosures/fire protection
Column grid dimensions
Column grid outside building
Column tags
Column tags (should be referenced from Structural Column Plan if possible)
Combination system
Communication panel
Component identification numbers

Concealed wiring and conduit
Concrete
Concrete outline (no patterning)
Concrete walls
Condensate piping (includes fittings, valves, instrumentation)
Connectors, faucets, hydrants, rectifiers,reducers, regulators, sprinklers, markers, vents, intake points, tanks, taps, backflow preventers, valves, meters, and pumps
Construction joints
Construction limits with annotation
Construction limits, staging area
Construction limits/controls
Construction lines, reference targets, area calculations, review comments
Construction lines, reference targets, area calculations, review comments, viewport windows
Contacts
Control wiring and tubing (including pneumatic)
Control/expansion joints
Controls, instrumentation, diagrams, schematics, and equipment
Controls, instrumentation, sensors, and equipment
Coordinate grid tics and text
Coordinates
Copiers, fax machines, office equipment
Covers and fittings
Crickets flow arrows flow info
Culverts, drainage inlets, storm drains
Culverts, headwalls, drainage inlets - annotation
Curbs with annotation
Curtain wall mullions and glass
Cut/fill slopes
Cut/fill slopes - annotation
Cut/fill slopes, symbols
Data/LAN system symbols
Decks
Defueling piping
Demolition
Demolition (Note: comprehensive demolition is handled in Model File Type: Demolition Plan)
Detail title text, text and associated leaderlines and arrowheads, notes
Diffuser tags
Directory signage
Discipline: Electrical
Distribution boxes, junction boxes and manholes
Ditches with annotation
Domestic cold water piping
Domestic cold water piping (includes fittings, valves, risers, etc.)
Domestic filtered water piping
Domestic hot and cold water risers
Domestic hot water piping
Domestic hot water piping (includes fittings, valves, risers, etc.)
Domestic hot water recirculation piping
Domestic hot water recirculation piping
Domestic water service piping
Domestic water source

Door and window headers (appear on Reflected Ceiling Plan)
Door and window jambs (do not appear on Reflected Ceiling Plan)
Door number and symbol, hardware group, etc.
Double poles
Down guy wires
Downspouts, grease traps, grit chambers, markers, meters, flumes, neutralizers, oil/water separators, pumps, ejectors, septic tanks, tanks, and valves
Ductbanks
Ducts
Ductwork
Earth
Earth/soil
Easements
Easements with annotation
Egress requirements designator
Electric device
Electrical
Electrical wiring
Elevated grading
Elevated grating (catwalks)
Elevator cars and equipment
Elevator framing
Embankment annotation
Embankment centerlines
Embankment edge and object lines
Emergency fixtures
Emergency lights (use only when Electrical lighting symbols are unavailable)
Energy management equipment
Energy management wiring
Energy monitoring control system symbols
Equipment
Equipment (e.g., controllers, valves, RPBPs, etc.)
Equipment (e.g., fire hose cabinets, extinguishers, etc.)
Equipment (fire extinguisher)
Equipment (fire hose cabinet)
Equipment (sand/oil/water separators)
Equipment access
Equipment access doors
Equipment and fixtures
Equipment identification numbers
Equipotential ground system
Erosion control
Exhaust air ceiling diffusers
Exhaust makeup air ceiling diffusers
Existing machinery
Existing to remain
Exit fixtures
Expansion joints
Exposed wiring and conduit
Exterior full height walls
Exterior mounted access control devices

Exterior wall materials
External flood lights
Extra Wide Block/Riser Linework
Extra wide linework
Extra wide one-line linework
Extrusions and formed shapes
Fans
Fastener
Fasteners
Fasteners, nuts, and bolts
Feeders
Fence/ trail/ sign annotation
Fences
Fences/gates
Fencing
Fiber optics cable
Field information
Field interfaces, multiplexers, markers
File cabinets, high density storage, shelving, storage cabinets
Fill
Fill/cover material
Filtration beds
Fine Block/Riser Linework
Fine linework
Fine one-line linework
Finish patterns
Finished grade
Finishes, woodwork and trim
Finishes, woodwork, trim
Fire alarm and detection system symbols
Fire alarms
Fire equipment (fire extinguishers)
Fire wall designators (patterning)
Fixed equipment
Flashing
Floor deck
Floor drains and cleanouts
Floor grading
Floor grating
Floor materials
Floor mounted fixtures (e.g. stage, etc.)
Floor mounted sensor
Floor mounted/Free standing miscellaneous fixtures (not including toilet fixtures)
Floor outline/perimeter/building footprint
Floor outline/perimeter/building footprint (should be referenced from Floor Plan if possible)
Flooring (carpet, rugs, etc.)
Flow direction arrows
Flush mounted switches/contacts
Footings
Foundation reinforcing
Free-standing Tables and desks (conference, classroom, coffee, end, etc.)

Freestanding furniture
Fuel distribution equipment
Fuel distribution return piping
Fuel distribution supply piping
Fuel gas general piping (includes fittings, valves, instrumentation)
Fuel gas process piping (includes fittings, valves, instrumentation)
Fuel oil general piping (includes fittings, valves, instrumentation)
Fuel oil process piping (includes fittings, valves, instrumentation)
Full height (to ceiling) door: swing and leaf
Full height glazed walls and partitions (see A-WALL-CWMG for curtain walls)
Furniture
Furniture code identification
Furniture, furnishings
Fuse cutouts, pole mounted switches, circuit breakers, gang operated disconnects, reclosers, cubicle switches
Fuses
Future work
Gas piping, features, valves and text
General features
General features (miscellaneous items)
General notes and general remarks
Generators
Generators and utilization equipment symbols
Glass/foil mounted sensor
Glazing
Governor or high pressure brake lines
Grade beams
Graphic illustration of cars
Grass, sod
Grilles and louvers
Grit chambers, markers, meters, flumes, neutralizers, oil/water separators, pumps, ejectors, tanks, and valves
Ground system diagram
Ground water
Groundcover and vines
Grounding systems - lightning protection
Grounds
Guardrails with annotation
Halon equipment
Halon piping
Handrails
Hardware
Hazardous waste (see HTRW Model File Type: Demolition Plan for more extensive projects)
Hazardous waste (see HTRW Model File Type: Demolition Plan for more extensive projects)
High density storage, specialty storage
High pressure equipment
High pressure piping (includes fittings, valves, instrumentation)
High temperature service piping
High temperature water plant
Hoists and hooks

Horizontal column grid outside building (should be referenced from Structural Column Plan if possible)
Horizontal grid lines
Hot and cold water equipment
Hydrant control pits
Hydrant fill points, lights, vents, markers, meters, pumps, reducers, regulators, sources, tanks, drip pots, taps, and valves
Hydraulic system equipment
Hydraulic system return piping
Hydraulic system supply piping
Hydroseeding
Hydroseeding, Seed
Hydroseeding, Seed, Sod
Hydroseeding, Seed, Sod, Sprig
Hydroseeding, Seed, Sprig
Hydroseeding, Sod
Hydroseeding, Sprigs
Identifier tags, symbol modifier, and text
Identifiers and leaderlines
Identifiers and text for revisions, amendments, addendums, and modifications
Identifiers tags, symbol modifier, and text
Industrial exhaust air ceiling diffusers
Industrial water service piping
Inert gas equipment
Inert gas piping
Insulating oil equipment
Insulating oil return piping
Insulating oil supply piping
Insulation
Insulation and coverings
Intercom/PA system symbols
Intercoms/speakers
Interior and exterior signage
Interior full height walls
Interior wall materials
Irrigation coverage, spray distribution patterns
Irrigation head for turf
Items to be moved
Joint materials (e.g., felt), vapor barrier, other
Joint patterns, text and dimensions
Junction boxes
Junction boxes and manholes
Junction boxes, manholes, handholes, test boxes
Junction boxes, pull boxes, manholes, handholes, pedestals, splices
Keynotes with associated leaderlines and arrowheads, ConDoc keynotes
Laboratory information
Ladders, ladder handrails, safety guard, grab bars
Lagoons
Large rotating machinery (turbine and pump outlines)
Lateral bracing
Legend linework

Level changes
Level changes, shafts, ramps, pits, breaks in construction, and depressions
Light fixture identifier tags
Light fixtures
Lighting circuit hash marks
Lighting circuit home run arrow
Lighting circuit numbers
Lighting circuits
Lighting circuits concealed in floor and conduit
Lighting components
Lighting outline for background (optional)
Load bearing CMU walls
Low pressure piping (includes fittings, valves, instrumentation)
Low temperature service piping
Low voltage wiring
Lubrication oil equipment
Lubrication oil return piping
Lubrication oil supply piping
Machinery bases
Machinery motors
Main chilled water piping
Main domestic water piping
Main fuel piping
Main gas piping
Main high temperature piping
Main industrial water piping
Main low temperature piping
Main steam piping
Main tees
Main waste water piping
Major contours
Major contours - annotation
Major contours annotation
Manual device
Masonry
Material beyond section cut
Material cut by section
Material pattern (e.g., insulation, hatching, and fill)
Material patterns (e.g., paving, tile, carpet)
Medical (exam beds, dental chairs, etc.)
Medium Block/Riser Linework
Medium linework
Medium one-line linework
Medium pressure piping (includes fittings, valves, instrumentation)
Membrane/netting
Metering Devices
Millwork/casework/trim
Minor contours
Minor contours - annotation
Minor contours annotation
Miscellaneous (e.g., window treatments, accessories, etc.)

Miscellaneous alarm system symbols
Miscellaneous door symbols (e.g., overhead, bifold, pocket, etc.)
Miscellaneous fasteners, anchor bolts, supports
Miscellaneous fixtures
Miscellaneous furniture
Miscellaneous lifting equipment
Miscellaneous machinery parts and components
Miscellaneous metal
Miscellaneous patterning
Miscellaneous patterning, cross-hatching, poche
Miscellaneous patterning, cross-hatching, poche (see also A-ROOF-PATT)
Miscellaneous symbols
Miscellaneous text and callouts with associated leaderlines and arrowheads
Motors
Motors and utilization equipment symbols
Moveable equipment
Moveable walls/partitions
Mulching outlines
Multi-conductor cable
New work
Nitrification drain fields
Non-load bearing CMU walls
Non-potable water piping
Not in contract
Not in contract equipment
Nurse call system symbols
Occupant or employee names
Openings and penetrations
Other diffusers
Other ductwork
Other inlets and outlets (use only when Mechanical HVAC symbols are unavailable) see M-HVAC-ODFF
Other piping and text
Overhead cables
Overhead electrical utility lines
Overhead items (skylights, overhangs etc.)
Overloads
Paging system symbols
Panels
Parking islands
Parking lot drainage slope indications
Parking lot striping, handicapped symbols
Parking lots and minor roads - annotation
Parking lots and minor roads - outlines
Partial height door: swing and leaf
Partial height walls (do not appear on Reflected Ceiling Plan)
Patterns
Pavement joint annotation
Pavement joints
Pavement markings
Pavements

Phase numbers (#=1-9)
Physical outline of electrical equipment (e.g. cabinets, enclosures, etc.)
Physical outline of electrical equipment (e.g., MCC switchboards, panelboards, etc.)
Physical outline of electrical equipment (e.g., panels, etc.)
Piles (steel sheet, concrete, wood), piers, caisson piers, drilled piers
Pipe and conduit
Piping
Piping (includes fittings, valves, instrumentation)
Piping and conduit
Piping, conduit, sprinklers
Planning Grid/modular outline
Planting plants
Plants
Play structures
Plumbing fixtures
Plumbing fixtures (use only when Plumbing Piping Plan: P-SANR-FIXT is not available)
Plumbing fixtures in elevation
Pole mounted lights
Pole mounted security lighting
Pole mounted transformers
Pole risers
Ponds with annotation
Pools
Power circuit home run arrows
Power circuit numbers
Power circuits
Power circuits - hash marks
Power circuits concealed in floor and conduit
Power lines, lights, telephone lines, features, poles and text
Power outline for backgrounds
Power panels/distribution equipment
Power switchboards
Power, communication components
Precast walls
Pressure reducing station
Primary beams, girders
Primary columns
Primary joists
Process piping
Profiles and x-sections, grid borders, grid lines, coordinate grid with annotation
Property lines with annotation
Pump stations
Pumps
Pumps and compressors
Railroad - annotation
Railroad - outlines
Ramps
Raw water equipment
Raw water piping
Reactors
Rebar, welded wire mesh

Reducing stations
Reference bubbles, matchlines and breaklines
Reference files (AutoCAD users only, see Chapter 4)
Reference ground system
Relays
Relocated items
Remote station
Reservoirs
Resistors
Retaining wall
Return air diffusers
Return ductwork
Return for all HTCW lines
Return piping
Revetments, stone protection, breakwaters, dikes, jetties, drains
Revetments/stone protection/breakwaters/dikes/jetties/drains annotation
Right of ways with annotation
Right-of-ways
Rigid anchors, anchor guides, reducers, markers, meters, pumps, regulators, and valves
Road - annotation
Road - outlines
Roads, parking lots, railroads, airfield pavements annotation
Roads, parking lots, railroads, curbs, runways, taxiways, aprons
Roads/parking lots/railroads/airfield pavements annotation
Rock, bark, and other landscaping beds
Roof deck
Roof drain piping
Roof drains
Roof internal gutters
Roof lighting
Roof materials
Roof perimeter/edge, roof geometry
Roof power
Roof specialties, accessories, access hatches
Roof surface patterns, hatching
Roof walkways
Room name, space identification text
Room numbers, tenant identifications, area calculation
Room perimeter shape (Interior walls)
Room/space identification number and symbol
Sanitary risers
Schedule linework
Secondary beams, girders
Secondary columns
Secondary joists
Security system symbols
Security wiring/circuits
Seed
Seed, sod
Seed, sod, sprig
Seed, Sprig

Sensor control unit
Sensors
Service piping
Shear walls
Shop and control air equipment
Shop and control air piping
Shoulders with annotation
Shrub (Existing, Not shown on topo or survey)
Shrub Line
Shrub location for drip/sprinkler heads
Shrubs (e.g. evergreen, deciduous)
Shrubs (e.g., evergreen, deciduous)
Signage
Signs
Single pole
Site annotation
Site furnishings
Site improvements
Site lighting (see also utilities discipline)
Site plan - keyplan
Site power (see also utilities disciplines)
Slab control joints
Slab outline
Slab reinforcing
Smoke detectors, heat sensors
Sod
Soil boring layout
Sound system symbols
Span guy wires
Special features
Special fixtures
Sports fields
Spot elevations
Spot elevations, joint elevations
Sprinkler - other
Sprinkler - pendant
Sprinkler - upright
Sprinkler piping
Sprinklers
Stair and balcony handrails, guard rails (except handicap grab bars)
Stair control joints
Stair handrails, nosings, guard rails
Stair reinforcing
Stair risers/treads, escalators, ladders
Stair risers/treads, ladders
Stairs
Station drainage equipment
Station drainage piping
Steam service piping
Steel stud walls
Steps

Storage components
Storm drain inlets - curb
Storm drain manholes
Storm drain piping
Storm drain risers
Storm drainage headwalls
Storm drainage pipe-underground
Storm drainage, headwalls, inlets, manholes, culverts, drainage structures
Storm drainage, headwalls, inlets, manholes, culverts, drainage structures annotation
Storm drainage/headwalls/inlets/manholes/culverts/drainage structures annotation
Storm water
Street lights
Structural features
Structural metal
Structural metal, supports
Structural support features
Sub-surface areas
Substations
Supply diffusers
Supply ductwork
Supply piping
Surface areas
Surface mounted lights (pendant, etc.)
Surface mounted switches/contacts
Survey and control line
Survey and control line annotation
Suspended elements, ceiling mounted specialties (e.g., clocks, fans, etc.)
Swales, ditches
Swales,All grading Information
Switches
Switches, contactors, disconnect switches, etc.
Switches, motor starters, contactors, disconnect switches, etc. - symbols
Systems furniture partition walls
Systems furniture/pre-wired workstations
Tanks
Taxiway - annotation
Taxiway - outlines
Taxiway joints
Telephone system symbols
Television antenna system symbols
Television system symbols
Temporary work
Textures and hatch patterns
Thermostats
Thin Block/Riser Linework
Thin linework
Thin one-line linework
Toilet partitions and handicap grab bars
Top/toe slopes
Topo breaklines
Towers

Transformers
Traps and drains
Travel distances
Treatment plants
Tree Line
Tree location for drip/sprinkler heads
Trees (e.g. evergreen, deciduous, etc.)
Trees (e.g., evergreen, deciduous, etc.)
Trees, plants
Trim
Trusses
Type A traffic area with annotation
Type B traffic area with annotation
Type C traffic area with annotation
Under carpet wiring
Underfloor raceways
Underground cables
Underground electrical utility lines
Valve pits
Valves and fittings
Vaults
Vent piping
Vent pits
Vents
Vertical bracing
Vertical column grid outside building (should be referenced from Structural Column Plan if possible)
Vertical grid lines
Walks and steps
Walks and steps - patterning/hatching
Walks and trails
Walks and trails
Walkway lights
Wall centerlines
Wall fire ratings (see also A-WALL-FIRE on Model File Type: Floor Plan)
Wall identification/type text or tags
Wall mounted (interior) access control devices
Wall mounted casework
Wall mounted CCTV
Wall mounted communication equipment
Wall mounted fixtures
Wall mounted lights (use only when Electrical lighting symbols are unavailable)
Wall mounted security lighting
Wall mounted sensor
wall outlets and receptacles
Wall-hung/attached specialties (e.g., fixtures, grab bars, telephone booths, toilet accessories, etc.) see A-FLOR-PFIX for toilet fixtures
Wall-mounted casework
Walls
Waste water service piping
Water piping, hydrants, tanks, valves and text

Weld symbols
Welding symbols
Wide Block/Riser Linework
Wide flange shapes, plates, open web joists, decking, bolts, nails
Wide linework
Wide one-line linework
Window number and symbol
Window sills
Windows and partial height glazed partitions
Wire and cables
Wiring
Witness/extension lines, dimension arrowheads/dots/slashes, dimension text
Witness/extension lines, dimension arrowheads/dots/slashes, dimension text
Wood outline (no patterning)
Work surface components